

INTERUNIS-IT

A-Line 32D

User manual

2012

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Chapter 1. Getting Started

- * Chapter “*Getting Started*” gives a brief overview of system capabilities and interface.

1.1. A-Line features

This software product supports two modes of system operation.

- ✧ **On-Line** mode (hardware component connected) – the mode for data collection and postprocessing.
- ✧ **Off-Line** mode (hardware component disconnected)) - the mode for postprocessing only.
- ◇ In data collection mode the following will be performed:
 - system parameters setup;
 - system administration during the data logging (startup, temporary shutdown and subsequent startup, complete shutdown of the system);
 - graphic representation of the obtained data in the real time mode;
 - recording the obtained data into a file or exporting it to a text file;
 - defects location for different types of location (linear, plane, cylindrical vessels, spherical vessels, conic vessels, reservoir bottoms, zonary, 3D and picture) at independent sensors arrangement.
- ◇ In the postprocessing mode the program provides for the following options:
 - reading data from files, their graphical and text representation;
 - creation of dependence graphs between any parameters and histograms for events distribution after any parameter;
 - data filtering after the following parameters:
 - time;
 - channel number;
 - amplitude;
 - energy;
 - time of the AE pulse rise;
 - duration of the AE pulse;
 - counts of threshold crossings in the AE pulse;
 - average frequency;
 - optional flags;
 - data filtering after location results (coordinate, location amplitude, cluster power);
 - filtering after formula;
 - filtering after clusterization results;
 - filtering after area;

- possibility of saving and subsequent work with data obtained in the result of filtering;
- data export into the text format;
- data export from parameter channels into the text format.

1.2. Measured and programmed channel parameters

ALine 32D represents a multichannel system for AE pulse registration, where every channel operates independently from other channels. Every channel includes a Former for AE pulse parameters (PF). Objectives for every PF consist of AE pulse (AEP) registration and forming a measured parameters block for:

- ◇ maximum AEP amplitude;
- ◇ AEP energy;
- ◇ time of the AEP beginning registration;
- ◇ time of the AEP peak amplitude registration;
- ◇ time of the AEP end registration.
- ◇ counts of the AEP threshold crossings.

For correct extraction of the AEP against noises in the background, in addition to measured parameters there is a set of programmed parameters for every channel and namely:

- ◇ gain or main amplifier (**Gain**);
- ◇ discrimination threshold (**Threshold**);
- ◇ peak amplitude formation timeout (**RTTO**);
- ◇ AEP end timeout (**SCETO**);
- ◇ maximum AEP duration (**Duration max**);
- ◇ dead time (**Dead time**).

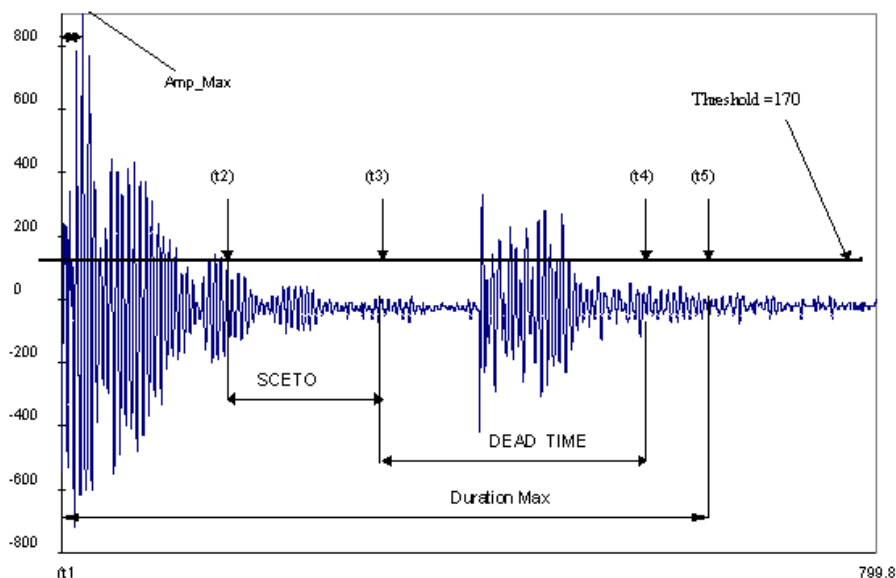


Fig. 1.1. Oscillogram of the real AE pulse waveform

The figure above displays the oscillogram of the real AE pulse. Amplitude values of the AE pulse are displayed on the vertical (the scale is graded in ADC points for convenience) axis, time is displayed on the horizontal axis. By using this figure, we can examine the principles of the AE event formation.

1.3. Results display windows

- ◇ **Averaged amplitude, [dB] / Time, [s]** - average value of the AEP maximum amplitude for every channel during the averaging period.
- ◇ **AE activity / Time, [s]** - the number of AEP's for every channel during the averaging period (intensity).
- ◇ **Events run-on / Time, [s]** - total number of AEP depending on the time for every channel from the moment of the data retrieval.
- ◇ **Events summary/ Channel** - histogram of the total number of AEP from the moment of the system startup for every channel until the current moment of time.
- ◇ **Averaged energy, [dB] / Time, [s]** - average value of the AEP energy for every channel during the averaging period.
- ◇ **Energy run-on, [dB] / Time, [s]** - total accumulated value of the AEP energy for every channel during from the moment of the data retrieval.
- ◇ **Averaged rise time, [mcs] / Time, [s]** - average value of the AEP rise time for every channel during the averaging period.
- ◇ **Averaged duration, [mcs] / Time, [s]** - average value of the AEP duration for every channel during the averaging period.
- ◇ **Averaged amplitude total, [dB] / Time, [s]** - the sum of the average values of the AEP maximum amplitude for all the channels during the averaging period.
- ◇ **Total AE activity / Time, [s]** - average value of the AEP number for all the channels during the averaging period (total intensity).
- ◇ **Noise level, [dB] / Channel** - histograms of the obtained noise level, threshold value and minimal noise level for every channel.
- ◇ **Averaged noise level, [dB] / Time, [s]** - average value of the obtained noise level for every channel during the averaging period.
- ◇ **Averaged counts / Time, [s]** - the averaged number of threshold crossings in the AEP for every channel during the averaging period.
- ◇ **Counts run-on / Time, [s]** - total accumulated value of the AEP counts for every channel during from the moment of the data retrieval.
- ◇ **N. Digital Oscilloscope: [ADC Scale/mcV/dB] / Time, [mcs]** - digital oscillogram of the AEP waveform for the channels selected to output into this window. The number N of these windows can be from 1 up to 50.
- ◇ **N. Spectral power: $[(J \cdot 10^{-26} / \text{kHz})^{1/2}] / \text{Frequency, [kHz]}$** - frequency spectrum of the AEP waveform for the channels selected to output into this window. The number N of these windows can be from 1 up to 50.
- ◇ **<Parameter N / Time, [s]>** - the averaged value of the external parametric measurements (e.g. pressure, temperature etc.), which come from the sensors, connected by the user. The number N of these windows can be from 1 up to 4 for DDM

system type and from 1 up to 2 for PCI system type. The title of these windows can be change by user

- ◇ **Threshold, [dB] / Time, [s]** - graph of the threshold value for every channel.
- ◇ **Gain, [dB] / Time, [s]** - gain values for every channel.
- ◇ **N.<Group name> Loc. Amplitude loc., [dB] / Size, [mm][<Group type>]** - distribution of the average or maximum location amplitude on coordinates. N is the number of location group named <Group name> and of type <Group type>, N is unlimited.
- ◇ **N.<Group name> Location / Size, [mm][<Group type>]** - coordinates of the located events. N is the number of location group named <Group name> and of type <Group type>, N is unlimited.
- ◇ **N.<Group name> 3D Model of location [<Group type>]** - 3D model of localized object for cylinder, spherical or conic location. N is the number of location group named <Group name> and of type <Group type>, N is unlimited.
- ◇ **N.<Group name> Located AE run-on / Time, [s]** - total accumulated value of the AE event located by location group named <Group name> during from the moment of the data retrieval.
- ◇ **Amplitude Attenuation Histogram N / Attenuation, [dB/m]** - histograms of the obtained attenuation distribution.
- ◇ **Velocity Measurement Histogram N / Velocity, [m/s]** - histograms of the obtained velocity distribution.
- ◇ **Max. amplitudes, [dB] / Time, [s]** - maximum AEP amplitude values for every channel between all AEP maximum amplitude obtained during averaging period.
- ◇ **Max. counts / Max. amplitude, [dB]** - maximum AEP count vs maximum AEP amplitude values for every channel between all AEP obtained during averaging period.

It is worth mentioning that the program has a capability of building dependence graphs between any parameters in **On-Line** and **Off-Line** (preferable) modes. A more detailed description of this operation is given in “*Windows manager*” on page 72.

1.4. File types

- ◇ *Data files* - contain information on measured parameters of all the registered AEP, noise level and data, obtained from the parametric channels. Files of this type have the **.ALD** extension. Earlier versions of this software product used the **.DAT** extension, which can be used as well.
- ◇ *OSC-files (oscilloscope files)* - contain the Oscilloscope waveforms. Files of this type have the **.OSC** extension. Earlier versions of this software product used the **.SDO** extension, which can be used as well.
- ◇ *Configuration files* contain the system settings (channel parameters, windows arrangement, other settings). Files of this type have the **.CFG** extension.
- ◇ *Files of location settings* contain information on location groups. Files of this type have the **.LFG** extension.
- ◇ *Velocity measurement parameters files* contain the parameters of velocity measurement schemes. Files of this type have the **.VFG** extension.

- ◇ *Data filtration parameters files* contain the parameters of data filtering. Files of this type have the **.FLT** extension.
- ◇ *A-Line project parameters files* contain the parameters of working A-Line project. Files of this type have the **.ALP** extension.
- ◇ *Files with additional line description* contain additional lines description, placed on the windows. Files of this type have the **.NAG** extension. It is also possible to use the **.TXT** extension for this file type.
- ◇ *Imported graphics files* contain the images placed on the 2D windows. ALine 32D can work with the following formats of graphical files: *Windows metafile* (files with the **.WMF** extension) and *Enhanced Metafile* (files with the **.EMF** extension). For creation of imported graphics files, it is necessary to use graphics editor creating images in vector format (e.g. *CorelDraw* or *Visio*).
- ◇ *Imported 3D graphics files* contain the images placed on the 3D windows. ALine 32D can work with the following format of 3D graphical files: *ASCII Scene Export* (files with the **.ASE** extension). For creation of 3D imported graphics files, it is necessary to use graphics editor exporting images in ASE format (e.g. *AutoCAD*).

1.5. Main menu

File menu

All the options related to operations with files are concentrated in this menu. It contains the following options:

Option	Action
Create project	Creates an A-Line project from the selected files and saves them in the selected subfolder.
Open	Opens (loads) a data (ALD) file.
Show Header	Shows information about opened data (ALD) file.
Save	Saves the data of the current measurement into a file.
Open OSC Wave	Opens (loads) an oscillogram (OSC) file.
Show OSC Header	Shows information about opened oscillogram (OSC) file.
OSC Save OSC	Saves an oscillogram (OSC) file.
Open project	Opens an A-Line project file.
Close project	Closes an A-Line project file.
Printer setup	Sets the printer parameters.
Print	Prints data.
Filter and review	Filters and text views of the selected data (ALD) file.
Filter current file	Filters and text views of the opened data (ALD) file.
Concatenation	Concatenates data from files.
Export ALD Data	Transforms data (ALD) files into text format.
Export OSC data	Transforms oscillogram (OSC) files into text format.
Create Config	Creates a system configuration (CFG) file.
Open Config	Loads a system configuration (CFG) file.

Option	Action
Save Config	Saves a file of the current system settings in configuration (CFG) file.
Exit	Exits the program.

View menu

The **View** menu options allow setting up the working field of the program for more convenient results representation.

Option	Action
Toolbar	Switches the toolbar on and off.
View Bar	Switches the viewing bar on and off.
Page Bar	Switches the pages bar on and off.
Read Bar	Controls the process of reading the data files.
Calibration Bar	Controls the process of reading the data files.
Status Bar	Switches the status bar on and off.
Project Work Space	Shows the file list of the current opened/created A-Line project.
Sync. View	Views the parameters of the registered AEP in the text format during the data retrieval (On-Line mode).
Zoom in	Increases the scale of the image.
Zoom out	Decreases the scale of the image step-by-step.
Zoom back	Decreases the scale of the image rapidly.
Sinc. Scrolling	Scroll all time dependence windows synchronously in case of use scroll axis mode.
X-Axis	Switches the X-axis in the active window on and off.
Y-Axis	Switches the Y-axis in the active window on and off.
Z-Axis	Switches the Z-axis in the active window on and off.

Control menu

The **Control** menu options provide for complex administration during the data registration. All the options of this menu, except the **New Measurement** are available in the **On-Line** mode only.

Option	Action
Start	Starts the system.
Stop	Stops the system
Pause	Temporary system shutdown.
Continue	Resumes operations after the temporary shutdown.
Noise events ON/OFF	Turns the noise packs reception mode on or off.
Sound ON/OFF	Turns the audio signal on or off.
Autothreshold	Turns the automatic threshold mode on or off.
OSC Start	Starts the Oscilloscope channel.
OSC Stop	Stops the Oscilloscope channel.

Option	Action
OSC Record	Turns the oscillogram record mode on of off.
New Measurement	Prepares for a new measurement.
Relogin	Relogin modules without power shutdown (for DDM type system only).
Marker	Insert text marker into data flow.

Location menu

The **Location** menu options allow setting the location parameters.

Option	Action
New Location	Creates new schemes of location groups.
Open Location	Opens previously saved location schemes.
Edit Current	Corrects parameters of current location schemes.
Close Current	Closes current location schemes.
Clear Locations	Temporary clears contents of all location windows.
Restore Locations	Restores contents of all location windows.
New velocity	Creates new scheme to determine the velocity of AEP distribution.
Open velocity	Opens previously saved scheme for velocity of AEP determination.
Edit velocity	Corrects current arrangement scheme for velocity of AEP determination.
Close velocity	Closes current velocity measurement scheme.
New calibration	Creates new scheme to calibrate installed AE sensors.
Open calibration	Opens previously saved scheme to calibrate installed AE sensors.
Edit current calibration	Corrects current arrangement scheme to calibrate installed AE sensors.
Close current calibration	Closes current arrangement scheme to calibrate installed AE sensors.

Classification menu

The **Classification** menu options allow classification of the AE sources according to their risk level.

Option	Action
Amplitude criterion	Applies an amplitude criterion.
Locally-dynamic criterion	Applies a local-dynamic criterion.
S-H diagram	Display a S-H diagram.
Statistic criterion	Applies statistic criterion.

Options menu

The **Options** menu options allow performing system parameters setup.

Option	Action
Channels parameters	Sets the gain (Gain), discrimination thresholds (Threshold), frequency bandwidth and representation channels for every channel.
OSC parameters	Sets oscilloscope channel parameters.
Time definition	Determines time parameters (SCETO , Dead Time , Max Duration) for every channel.
Calibration settings	Sets calibration pulsars parameters (only for DDM type system).
Parameters settings	Sets parametric channel parameters.
Profile settings	Sets hardware profiles manager.
Current window	Sets active window setup.
Hot Key	Sets hotkey system.
Settings	Sets general system parameters.

Window menu

The **Window** menu options provide for operations with windows.

Option	Action
Page Manager	Sets windows displaying pages manager.
Alarm Manager	Sets sound alarm manager.
Windows manager	Sets data windows manager.
Additional lines	Creates an additional (parametric) line.
Restore all	Restores all the working windows and arranges them in a certain order.
Cascade	Arranges the working windows sequentially one by one with a shift.
Tile	Arranges the working windows without overlapping.
Arrange Icons	Arranges the working windows minimized to pictograms.
9 names of windows on current visual page	Quickly activates a corresponding window.
More Windows	Allows activation of any window on current visual page.

Help menu

The **Help** menu options allow getting help on working with system.

Option	Action
Help Index	Displays help index
Help Topics	Displays help topics.
About	Displays brief information about the program.

1.6. Toolbar

The **Toolbar** consists of the buttons with pictograms displayed on them. Every button is connected with some operation, which in most cases duplicates a main menu item.

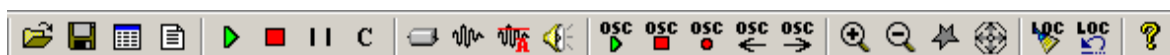


Fig. 1.2. Toolbar

Button	Duplicates a menu item or performs an operation.
	File-Open
	File-Save
	File-Review and Filter current file
	Control-New Measurement
	Control-Start
	Control-Stop
	Control-Pause
	Control-Continue
	Options-Channels parameters
	Options-OSC parameters
	Control-Autothreshold On/Off
	Control-Sound On/Off
	Control-OSC Start
	Control-OSC Stop
	Control-OSC Record
	Previous OSC wave
	Next OSC wave
	View-Zoom in
	View-Zoom out
	Draw region / polygon
	Shift visible area mode
	Location-Clear Locations
	Location-Restore Locations
	Help-About

1.7. Viewbar (Viewbar)

The **Viewbar** located to the left is intended for convenient work with the system. Detailed description of working with the **Viewbar** may be found in “Using the Viewbar” on page 21.

1.8. Status bar

The **Status bar** displays brief hints on working with menu and the **Toolbar**, as well as specifies the pointer position (X and Y coordinates) within the active window as well as additional information for some windows.



Fig. 1.3. Status bar

1.9. "Hotkeys"

In order to increase the convenience level while working with the program, provisions were made for using "the hotkeys" (combinations of different keys). Every keys combination allows on-the-fly activation of a main menu option.

"Hotkey"	Duplicates a menu item or performs an operation
Alt + N	File – Create project
Ctrl + O	File – Open
Ctrl + S	File – Save
Alt + O	File – Open project
Ctrl + P	File – Print
Alt + F4	File – Exit
Ctrl + F5	Control – Start
Ctrl + F6	Control – Stop
Ctrl + F7	Control – Pause
Ctrl + F8	Control – Continue
Ctrl + Shift + F5	Control – OSC Start
Ctrl + Shift + F6	Control – OSC Stop
Ctrl + R	Control – OSC Record
Ctrl + N	Control – New Measurement
Ctrl + L	Control – Relogin

We should note that the above mentioned "hotkeys" are the default hotkeys. At user's will it is possible to change the existing ones and add the new combinations. "Hotkeys" setup will be described in the *"Hotkeys setup"* on page 65.



Chapter 2. System control during measurement

* Chapter “*System control during measurement*” describes the preparation to the new measurement and system control during measurement.

2.1. Preparing for new measurement

Prior to data retrieval it is necessary to set the experiment parameters. For this, select the **Control-New Measurement** main menu option. After that, the **Measurement details** dialog box will appear.

Measurement details

Drive D: free 80976.6 MB

Measurement limits parameters

- ☒ Maximal measurement time: 0 hour(s) 2 min(s)
- ☒ Maximal pulse number: 50 pulses
- ☒ Maximal counts number: 1000 counts
- ☒ Maximal file size: 100 kBytes
- ☒ Maximal waves number: 1000 waveforms
- ☒ Restart measurement automatically

Initial time scaling: 0 hour(s) 3 min(s)

Averaging interval: 1 seconds ☐ Scroll

Saving options

- ☐ Don't write data to disk
- ☐ Don't write parameter channels' data to disk
- ☐ Don't write noise data to disk
- ☐ Don't write OSC wave to disk
- Number of OSC waves: Unlimited

File names for saving

Measured data: aem25_07_12#01.ald

OSC wave: aem25_07_12#01.osc

Configuration: alineddm.cfg

Information

Object name: Vessel

Operator: Joe Black

Reference:

Comments:

Pre-filter options

☐ Use data pre-filter

Fig. 2.1. **Measurement details** dialog box

This dialog box sets the parameters determining the forthcoming experiment:

- ◇ Enter the limits for measurement duration in the **Measurement limits parameters** group.

- Maximal measurement time duration will be checked and specified in the switch and entry fields for number of **hour(s)** and **min(s)**, located in the **Maximal measurement time** line. The time interval will be specified in hours and minutes. In case of the switch is checked, at the end of the time specified, data retrieval will be stopped.
 - Maximal number of AEP will be checked and specified in the switch and entry fields for number of **pulses**, located in the **Maximal pulse number** line. In case of the switch is checked, at the moment when specified number of AEP would come, data retrieval will be stopped.
 - Maximal number of AEP total counts will be checked and specified in the switch and entry fields for number of **counts**, located in the **Maximal counts number** line. In case of the switch is checked, at the moment when specified number of AEP total counts would come, data retrieval will be stopped.
 - Maximal data file size will be checked and specified in the switch and entry fields for **file size**, located in the **Maximal file size** line. The file size will be specified in kBytes. In case of the switch is checked, at the moment when specified data file size would be reached, data retrieval will be stopped.
 - Maximal AEP waveform number will be checked and specified in the switch and entry fields for **waveforms**, located in the **Maximal waves number** line. In case of the switch is checked, at the moment when specified waveform number would be reached, data retrieval will be stopped.
 - The switch **Restart measurement automatically** should be checked to restart measurement immediately after previous one have been stopped by any reasons described above. At least one limit switch should be checked. In case of several limits condition would be activated the measurement will be stopped after the earliest one will occur.
 - The initial time interval set in the window, will be specified in the entry fields for number of **hour(s)** and **min(s)**, located in the **Initial Time Scaling** line. The time interval will be specified in hours and minutes.
 - The averaging time of the data obtained, expressed in seconds, will be specified in the **Averaging Interval** entry field.
- ◇ Parameters for data saving should be entered in the **Saving options** group:
- The program provides for possibility do not save obtained basic data to the disk by setting the **Don't write data to disk** switch.
 - In case there is no need to save data from parametric inputs, it is necessary to set the **Don't write parameter channels' data to disk** switch.
 - In order to exclude writing the noise data to the disc it is necessary to set the **Don't write noise data to disk** switch.
 - The program as well provides for possibility do not save obtained AEP waveforms, by setting the **Don't write OSC wave to disk** switch.
 - The limit number of AEP waveforms written to the disc, should be entered in the **Max number of OSC waves** field.
- ◇ The names of the files for saving the basic data should be entered in the **File names for saving** group.

- The name of the file for saving the data can be entered either manually in the **Measured data** entry field, or selected by means of a standard dialog box for working with files, by pressing the **Browse** button.
- The name of the file for saving the waveforms of the received AEP can be entered either manually in the **OSC wave** entry field, or selected by means of a standard dialog box for working with files, by pressing the **Browse** button.
- The name of the configuration file will be specified in the **Configuration** field.
- ◇ Pre-filtering parameters can be set in the Pre-filter options group:
 - For switching the pre-filtering mode on it is necessary to set the **Use data pre-filter** switch.
 - Pre-filtering parameters can be set by pressing the **Edit pre-filter** button. After that, the **Filter Settings** dialog box will appear. More details on this dialog box can be found in “*Data filtering*” on page 36
- ◇ Comments to data can be set in the **Information** group. All of them are purely informational and used for convenience of data identification during the subsequent processing, without influencing the measurement process.
 - The name of the object will be specified in the **Object Name** entry field;
 - The name of the operator will be specified in the **Operator** entry field;
 - Additional information can be entered in the **Reference** entry field;
 - Comments will be specified in the **Comments** entry field.


After entering all the parameters it is necessary to press the **OK** button in the **Measurement Details** dialog box. The system will be ready for data retrieval. For canceling the set parameters it is necessary to use the **Cancel** button.





In case the data retrieval does not take place, the use of the **New Measurement** option only prepares the system for data collection. Registration of the AEP begins from the moment of performing the **Control-Start** option. Further description of the complex administration will be given below in the Chapter “*Complex operating during the data acquisition*”.


The **New Measurement** option is also available during the data retrieval. Using it at this moment will lead to completion of the current measurement and immediate start of the new measurement with the same parameters. At that, the data will be recorded to the new files without activating the corresponding dialog. For specifying the new file names, the automatic file names numbering of the previous (interrupted) measurement is used.

2.2. Complex operating during the data acquisition

In order to start the data acquisition process select the **Control-Start** option of the main menu or press the  button on the **Toolbar**, or use the [Ctrl-F5] key combination. From this moment, the experiment time countdown and registration of the AE pulses will begin.

Provisions are made for temporary system halt during the data acquisition without stopping the total experiment time countdown. For this, use the **Control-Pause** main menu option, or press the  button on the **Toolbar**, or use the [Ctrl-F7] hotkey

combination. In order to continue the operations use the **Control-Continue** main menu option, or press the  button on the **Toolbar**, or use the [Ctrl-F8] hotkey combination. After that, the system continues events registration.

For finishing the data registration use the **Control-Stop** main menu option, or press the  button on the **Toolbar**, or use the [Ctrl-F6] hotkey combination. The measurement will finish when any limit condition specified for this measurement in the **Measurement details** dialog box, described in the Chapter on page “*Preparing for new measurement*” on page 17 will complete. In this case, the system informs on the end of the data acquisition process.

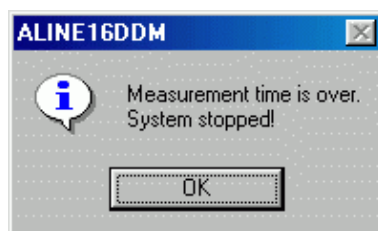




Fig. 2.2. **Time over** message

Oscilloscope control

Provisions are made for switching the oscilloscope channel on and off at any moment during the data acquisition except when in the **Pause** mode.


For starting the oscilloscope, you can use the **Control-OSC start** main menu option, or press the button  on the **Toolbar**.

For stopping the oscilloscope, use the **Control-OSC stop** main menu option, or press the  button on the **Toolbar**.

For saving the received oscilloscope waves, it is necessary to press the  button on the **Toolbar**, or use the **Control-OSC record** main menu option. In case this button was not pressed, the oscilloscope waves will be displayed on the screen but will not save. Note, that saving the oscilloscope waves may not be possible in case, while setting the experiment parameters the **Don't write OSC wave to disk** option was set in the **Measurement details** dialog box, described in the “*Preparing for new measurement*” on page 17. Besides, after saving the number of oscilloscope waves set while entering the experiment parameters, the possibility of save them may as well be lost.

2.3. Additional features

Controlling sound messages

The **Control-Sound ON/OFF** main menu is intended for systems equipped with sound-card. It allows switching the sound on/off. This option is not available for other systems. The  button on the **Toolbar** duplicates this option.

2.4. Using the Viewbar

The **Viewbar** is intended for convenient work with the program.



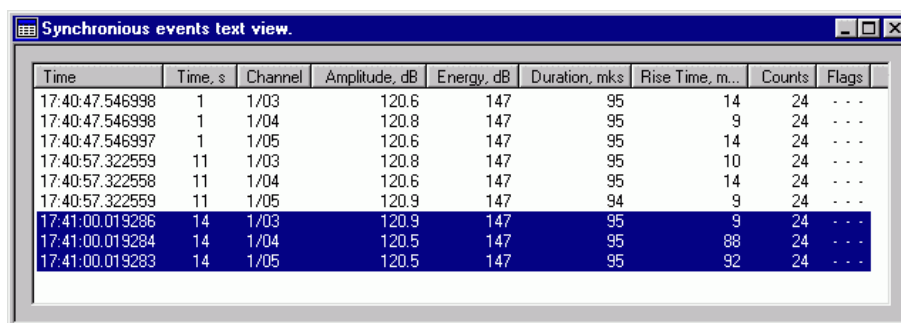
Fig. 2.3. Viewbar

- ◇ It can be used for every channel to:
 - switch a channel on and off by pressing a button with a channel number;
 - quickly determine a channel number by graph color;
 - switch display of the graphs corresponding to the given channel on and off, by activating and resetting the switches in the show column;
 - turn any oscilloscope channel on and off by checking the corresponding switch in the **OSC** column on.
- ◇ In order to quickly switch the display of all the channels on, activate the **all channels** switch. To switch the display of **all channels** off reset this switch.
- ◇ In order to quickly turn all oscilloscope channels on, activate the **turn on all OSC** switch. To turn all oscilloscope channels off reset this switch.
- ◇ In order to switch the display of the results graphs for channels constituting the corresponding location group, select the corresponding string in the location dropbox.
- ◇ The number of waveforms accumulated in the data retrieval mode will be specified in the **Nosc** field. The number of the currently opened waveform will be specified in this field in the postprocessing mode.
- ◇ The number of AEP accumulated during the data collection mode will be specified in the events sum field. The total number of AEP, contained in a file will be specified in this field in the postprocessing mode.
- ◇ In order to activate the **Location filter dialog** box for the location group selected, press the **Filter** button.
- ◇ The elapsed time from the beginning of the data retrieval will be specified in the lowest button of the **Viewbar**.

2.5. Synchronous view

Synchronous view (On-line mode)

When registering the AEP (**On-Line** mode) the program provides for viewing their parameters in text format. For this, select the **View – Sync. View** main menu option. After this, the **Synchronous text view** panel will appear.



Time	Time, s	Channel	Amplitude, dB	Energy, dB	Duration, mks	Rise Time, m...	Counts	Flags
17:40:47.546998	1	1/03	120.6	147	95	14	24	- - -
17:40:47.546998	1	1/04	120.8	147	95	9	24	- - -
17:40:47.546997	1	1/05	120.6	147	95	14	24	- - -
17:40:57.322559	11	1/03	120.8	147	95	10	24	- - -
17:40:57.322558	11	1/04	120.6	147	95	14	24	- - -
17:40:57.322559	11	1/05	120.9	147	94	9	24	- - -
17:41:00.019286	14	1/03	120.9	147	95	9	24	- - -
17:41:00.019284	14	1/04	120.5	147	95	88	24	- - -
17:41:00.019283	14	1/05	120.5	147	95	92	24	- - -

Fig. 2.4. Synchronous text view panel

In the opened window the real data not ordered by the time of AEP registration will be displayed. The parameters of the last pulses registered by the system will be displayed on the view page. The number of presented events will be determined by the size of the text view page, which can be changed at user's will.

For setting the size of the text view page, use the **Options-Settings** main menu option. Enter the size of the text view page in the open **General Settings** dialog box, (described in "Setting general system parameters" on page 59), in the **Size of the filter and text window page** entry field in the **Constants** group. The value 1000 is optimal for system operation.

During the data retrieval, constant update of information in the view page is performed after every averaging interval, which makes difficult the careful analysis of the incoming data. For more careful examination of the registered AEP you can temporarily suspend the data retrieval, by using the **Pause** button, and then using the scroll bar in the synchronous text view window.

Synchronous View (Off-Line mode)

The program provides for possibility of the registered AEP parameters synchronous view in the postprocessing mode. This function is available for location windows and for newly created windows. Note that for actual windows and histograms this function is not available.

For performing synchronous view in the location windows it is necessary to:

- ◇ select the **View-Sync. View** main menu option;
- ◇ increase the size of the location window you are interested in for higher convenience level;
- ◇ move the pointer to the point of interest;
- ◇ click the right mouse button.

The selected point will be framed by a rectangle of inversed color in order to increase the visualization level. After this a context menu appears, where it is necessary to select the **Impulse characteristic** option.

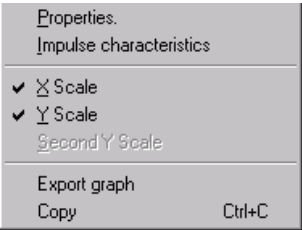


Fig. 2.5. Popup menu for display area

Then the records of all actual pulses, which led to location event with the coordinate selected, will appear in the synchronous text view window. In case of linear location, all the events are selected (the whole column). Every new demonstration will be highlighted in the synchronous text view window.

When a new window is created, the function of synchronous view for events with the current coordinate in the postprocessing windows is available. Note, that this procedure is not available for histograms.




Chapter 3. Files

* Chapter “Files” describes operations with files and project.

3.1. Working with files

Opening a data file

For loading the previously saved data, it is necessary to select the **File – Open** main menu option or press the  button on the **Toolbar**, or use the **Ctrl-O** key combination. Select the necessary file in the **Open File** standard dialog box and press the **Open** button. After that the **File Header** dialog box, described in the “*File header*” on page 25 Chapter will open. Note, that in this dialog box it is possible to change the file opening mode, including the **File reading panel** bar. Press the **OK** button to continue the file reading, or press the **Cancel** button for canceling the file reading.




File reading panel

You can change the speed of the recorded data files playback by activating the **File reading panel**, after resetting the **Show result diagrams only** switch in the **File Header** dialog box, as described in the “*Control elements*” on page 27 Chapter.



Fig. 3.1. File reading panel

Using this panel’s buttons, you can control the file reading process.

- ◇ For increasing the file reading speed, use the  (**Increase**) button. It is possible to change the playback speed from 1 (playback in real time mode) to 500 (500x increase of the playback speed). Playback speed is displayed in square brackets in the current temporal window in the lower part of the **Viewbar**.
- ◇ For decreasing the file reading speed, use the  (**Decrease**) button.
- ◇ For canceling the file reading, use the  (**Stop**) button. At that, file reading will be cancelled and the panel will disappear.

File reading can also be canceled with the help of the **View-File** reading panel main menu option, by resetting the **File reading panel** switch. After that, it will not be possible to activate the file reading panel from the main menu.

- ◇ For temporary halting the file reading process, use the  (**Pause**) button.

For removing the **File reading panel** during the temporary halt, select the **View-File reading panel** main menu option. For restoring the file reading panel select this main menu option again.

- ◇ For continuing the file reading, press the **C** (**Continue**) button.

After the end of file reading the **File reading panel** will disappear. The **View-File Reading Panel** main menu option will also become unavailable.

Saving a data file

The program provides for automatic saving of measurement data performed once per minute after the end of data retrieval and with the pause mode on. However, the forced data save between these two events is possible. For this, select the **File-Save** main menu option. The name of the file for storing the data will be specified when setting the experiment parameters.

Opening an oscillogram file

Opening oscillogram files is similar to opening a data file excluding the following:

- ◇ For opening oscillogram files a **File-Open OSC wave** main menu option is used;
- ◇ Instead of the **File Header** window the **OSC wave file header** window, similar to the **File Header** window, but containing additional information on oscillograms will appear. The **OSC wave file header** is described in “*Oscillogram file header*” on page 28.

Saving an oscillogram file

Use the **File-Save OSC** main menu option for saving oscillogram files. In case the file with such name already exists, the system prompts for rewriting the file. When pressing the **Yes** button, oscillograms will be saved in the file specified. When pressing the **No** button, the system will display the **Save File** dialog box, where it is necessary to specify the new file name and press the **Save** button. In case the file with the name specified does not exist it will be saved, otherwise, the system prompts to confirm the overwriting of the selected file again.

Pay special attention to the fact, that oscillograms are saved only at operator's request (and not automatically like data files).

3.2. File header

The **File Header** dialog box will appear when opening a data file, (procedure described on on page 24), or performing the filtering (operation described on on page 37). Besides, you can open this window when a data file is loaded by using the **File-Show Header** main menu option.

File header - D:\WORKDIR\ALLOC_MOD.497\aelm19_06_12#03.ald

Time settings info

System stop reason: Measurement time has expired

Initial time scaling: 0 hour(s) 3 min(s)

Averaging interval: 1 seconds ☐ Scroll time

Start time: 19.06.12 - 15:58:41

Stop time: 19.06.12 - 16:05:06

Measured data file options

File size: 155945

Pulses sum: 32

Source data file name: D:\ALDDM.496\data\aelm19_06_12#03.ald

File origin: Source data file

Loc. info:

☒ Noise data is present

☒ Parameter channels' data is present

☐ Pre-filter was used Show pre-filter

Additional info

☒ OSC waves file was written Max number of OSC wave: -1

OSC wave file name: D:\ALDDM.496\data\aelm19_06_12#03.osc

Configuration file name: D:\ALDDM.496\alineddm.cfg

General info

Object name: Vessel

Operator: Joe Black

Reference:

Comments:

☐ Show diagrams on-line view

☒ Show result diagrams only

☐ Show "Threshold, [dB] / Time, [s]" window

☐ Show "Gain, [dB] / Time, [s]" window

☒ Read channel colors from the file

☐ Read general settings from the file

☐ Open OSC waves file

OK Cancel Save header

Fig. 3.2. File Header dialog box

The **File header** window contains data file information and control elements.

Data file information

- ◇ Most information displayed in the **File Header** dialog box is obtained from a data file. It is divided into four groups.
 - system stop reason – in the **System stop reason** field;
 - initial size of the time scale – in the **Initial time scaling** fields;
 - averaging time - in the **Averaging interval** field;
 - time of the measurement start - in the **Start time** field; (**Start time**);
 - time of the measurement end - in the **Stop time** field.
- ◇ The **Measured data file** options group contains information on the data file:
 - file size - in the **File size** field;
 - number of AEP, contained in the file – in the **Pulses sum** field;
 - name of the source data file - in the **Source data file name**
 - data source - in the **File origin** field:
 - *Source data file* – for a data file, obtained in the result of measurement;

- *Filtered data file* - for a data file, obtained in the result of filtering;
 - *Location filtered data* - for a data file, obtained after filtering in the result of location;
 - file name and number of location group - in the **Loc.info** field;
 - whether the noise data was recorded - **Noise data** is present flag;
 - whether the parametric channels data was recorded - Parameter channels data is present flag;
 - whether a pre-filter was used - **Pre-filter was used** flag. Pre-filter settings can be viewed after pressing the **Show pre-filter** button.
- ◇ The **Additional info** group contains information on accompanying waveform OSC files and configuration:
- whether an oscillogram file was recorded- **OSC waves file was written**;
 - maximum number of oscillogram files – in the **Max number of OSC wave** field;
 - name of the oscillogram file - in the **OSC wave file name** field;
 - name of the configuration file - in the **Configuration file name** field.
- ◇ The **General info** group contains comments to a data file:
- object name - in the **Object name** field;
 - operator's name - in the **Operator field**;
 - notes - in the **Reference** field;
 - comments - in the **Comments** field.

Control elements

In addition to information on the data file the **File Header** dialog box contains a group of switches, allowing to change the process of data loading, its representation and the values of the adjustable parameters.

- ◇ When opening a data file use the following parameters to increase the loading and viewing convenience.
- The offered averaging time can be changed in the **Averaging interval** entry field. When the data level is high, we recommend increasing the offered value, since it accelerates the loading process.
 - The default initial size of the time scale can also be changed in the **Initial time scaling** entry field.
 - For your convenience, when viewing temporal diagrams, it is necessary to activate the **Scroll time** switch. It makes it possible to visualize the time scroll bar on all temporal diagrams. The width of the temporal window will correspond to the value set in the **Initial time scaling** entry field.
 - The **Show diagrams on-line view** switch makes it possible to build a diagram based on the registered events and their parameters. Otherwise, the diagrams are build on the basis of the data contained in the file.
 - The **Show result diagrams only** switch allows building diagrams not during the file loading, but after the end of it. This operation also decreases the loading time. For viewing the data accumulation process and construction of diagram, reset the **Show result diagrams only** switch. In this case, the **File reading panel** will appear after loading the file and with its help it is possible to control the file reading

process. Working with the **File reading panel** is described in “*File reading panel*” on page 24.

- ◇ The program provides for possibility of creating additional windows when opening a data file.
 - For creating the diagrams of threshold and amplification dependencies on time, set the **Show Threshold, [dB] / Time, [s]** window and the **Show Gain, [dB] / Time, [s]** switches.
 - For calling the corresponding OSC file (in case it was recorded during the data retrieval) use the **Open OSC waves file** switch.
- ◇ The program provides for possibility of using different system setup parameters at file loading.
 - Reading the channel color from the data file opened is permitted. For this, activate the **Read channel colors from the file** switch. Otherwise, the colors from the current configuration file will be used.
 - Provisions are made for using the general system parameters, saved in the opened data file, by setting the **Read general settings from the file** switch.
- ◇ By executing the **File-Show header** option and calling this window from the **Filter View** field dialog box, the fields of the **General info** group become available for editing. For saving the changes use the **Save header** button.

3.3. Oscillogram file header

The **OSC wave file header** dialog box will appear when opening an oscillogram file (procedure described on page 25). Besides, this dialog box can be opened when an oscillogram file is loaded, by using the **File-Show OSC Header** main menu option.

	N°	Time	Cha...	Wi...	Freq...	Num...	Durat...	Pre-tr...	Sync	Thre...	Thre...
<input checked="" type="checkbox"/>	1	10:49:12.645458	19	2/06	06	2000	1000	500	100	async.	< 15... < 5 >
<input checked="" type="checkbox"/>	2	10:49:12.716777	19	2/02	02	2000	1000	500	100	async.	< 15... < 5 >
<input checked="" type="checkbox"/>	3	10:49:12.722538	19	2/08	08	2000	1000	500	100	async.	< 15... < 5 >
<input checked="" type="checkbox"/>	4	10:49:12.720099	19	2/04	04	2000	1000	500	100	async.	< 15... < 5 >
<input checked="" type="checkbox"/>	5	10:48:58.242962	5	1/02	01	2000	1000	500	100	async.	< 15... < 5 >
<input checked="" type="checkbox"/>	6	10:48:58.243041	5	1/04	01	2000	1000	500	100	async.	< 15... < 5 >
<input checked="" type="checkbox"/>	7	10:49:12.718358	19	1/08	01	2000	1000	500	100	async.	< 15... < 5 >
<input checked="" type="checkbox"/>	8	10:48:58.242961	5	1/06	01	2000	1000	500	100	async.	< 15... < 5 >
<input checked="" type="checkbox"/>	9	10:49:12.740777	19	2/02	02	2000	1000	500	100	async.	< 15... < 5 >
<input checked="" type="checkbox"/>	10	10:49:12.755314	19	2/06	06	2000	1000	500	100	async.	< 15... < 5 >
<input checked="" type="checkbox"/>	11	10:48:53.000000	0	2/04	04	2000	1000	500	100	async.	< 15... < 5 >
<input checked="" type="checkbox"/>	12	10:48:58.242961	5	2/08	08	2000	1000	500	100	async.	< 15... < 5 >
<input checked="" type="checkbox"/>	13	10:48:58.242961	5	1/04	01	2000	1000	500	100	async.	< 15... < 5 >
<input checked="" type="checkbox"/>	14	10:48:53.000001	0	1/08	01	2000	1000	500	100	async.	< 15... < 5 >

Fig. 3.3. OSC wave file header box

The following groups of the **OSC wave file header** window contain information on an oscillogram file.

- ◇ The **Measurement info** group contains information on time parameters of the experiment:
 - experiment duration – in the **Max measurement time** fields;
 - time of the experiment beginning – in the **Start time** field;
 - time of the experiment end – in the **Stop time** field;
 - name of data file obtained in the result of measurements – in the **Source data file name** field. In case the data was not saved, the **Data was not recorded** message will appear in this field.
- ◇ The **OSC waves info** group contains information on the number of oscillograms in the file:
 - the actual number of oscillograms taken – in the **Real number of OSC wave** field;
 - the current oscillogram number – the **Current OSD wave №** spinner.

The current oscillogram selected will be displayed in the **Oscilloscope : <N>. Digital Oscilloscope: [ADC Scale/mkV/dB] / Time, [mks]** window. At that, the self-scaling of

the oscilloscope window on the Y-axis will be performed according to the full ADC scale or maximum of the current waveform (the **Axis Setup Dialog** dialog box). Calculation and display of the current oscillogram frequency spectrum will be performed in the data collection mode and displayed in the **<N>. Spectral power: $[(J \cdot 1e-26 / \text{kHz})^{1/2}] / \text{Frequen, [kHz]}$** window.

- ◇ When opening an OSC file the program provides for possibility of using different system parameter settings:
 - Simultaneous reading of an OSC file and a data file is possible. For this, activate the **Open corresponding data file** switch.
 - Procedure of reading general system parameters saved in the oscillogram OSC file being opened is available. For this, set the **Read general settings from the file** switch. Otherwise, general parameters will be read from the current configuration file.
- ◇ The **General Info** group contains comments to an oscillogram file:
 - object name - in the **Object name** field;
 - operator's name - in the **Operator** field;
 - notes - in the **Reference** field;
 - comments - in the **Comments** field.
- ◇ The lower part of the **OSC wave file header** window contains the following information on all the waveforms recorded:
 - oscillogram representation color – the column with colored squares. In case the whole large square is filled, it means assigning an individual channel color for this very channel. In case a small square within the big square is colored, it means the color assigned to an oscilloscope channel corresponds to the color selected for the data collection channel.
 - oscillogram number – in the **N** column;
 - time of the waveform arrival (absolute, measured accurate within mcs) and the time of the waveform relatively to beginning of the measurement – in the **Time** columns, correspondingly. Time measurement accurate within mks is used for calculating the acoustic wave velocity on an oscillogram.
 - number of the channel, from which an oscillogram was recorded – in the **Chan** column;
 - window number (one out of eight), in which an oscilloscopic channel will be displayed – in the **Window** column;
 - digitization frequency of an oscilloscopic channel – in the **Frequency quantization, kHz** column;
 - number of points in an Oscilloscope frame – in the **Number points** column;
 - oscilloscope scanning value – in the **Duration, mks** column;
 - oscilloscope operation modes- in the **Pre-triggering, Sync** columns (detailed description of the oscilloscope's operation modes is given in "Oscilloscope channels setup" on page 55);
 - threshold value in dB – in the **Threshold, dB** column;
 - threshold value in ADC units – in the **Threshold, ADC bits** column;

The information on oscillograms recorded will be represented in the view window and displayed in parts. The total number of pages is specified in the **Total** field. For viewing the next page it is necessary to press the **Next** button, and for returning to the previous page – the **Prev** button. Every transition is followed by a window displaying the loading process. For opening a file on arbitrary page use the **Current page** list. The number of data lines displayed on a single page will be set in the **General Setup** dialog box.

When executing the **File-Show OSC Header** option the fields of the **General Info** group will become available for editing. For saving the changes in the header, press the **Save header** button.

This window can be closed by using the **OK** button. When opening an oscillogram file, pressing the **OK** button will continue the data file loading, pressing the **Cancel** button cancels loading.

3.4. Concatenation (data files concatenation)

When conducting different tests, often there are situations, when the need for merging the data contained in several files exists. The program provides for this possibility. It allows merging the unlimited number of files.



The files with starting time difference of not more than 48 hours can be merged.

At that, the time of the signal records time intervals in the files merged should not intersect. Otherwise, the program displays a message specifying the names of the files unsuitable for merging.

Select the **File-Concatenation** main menu option for data merging. After that the **Concatenation settings** dialog box appears.

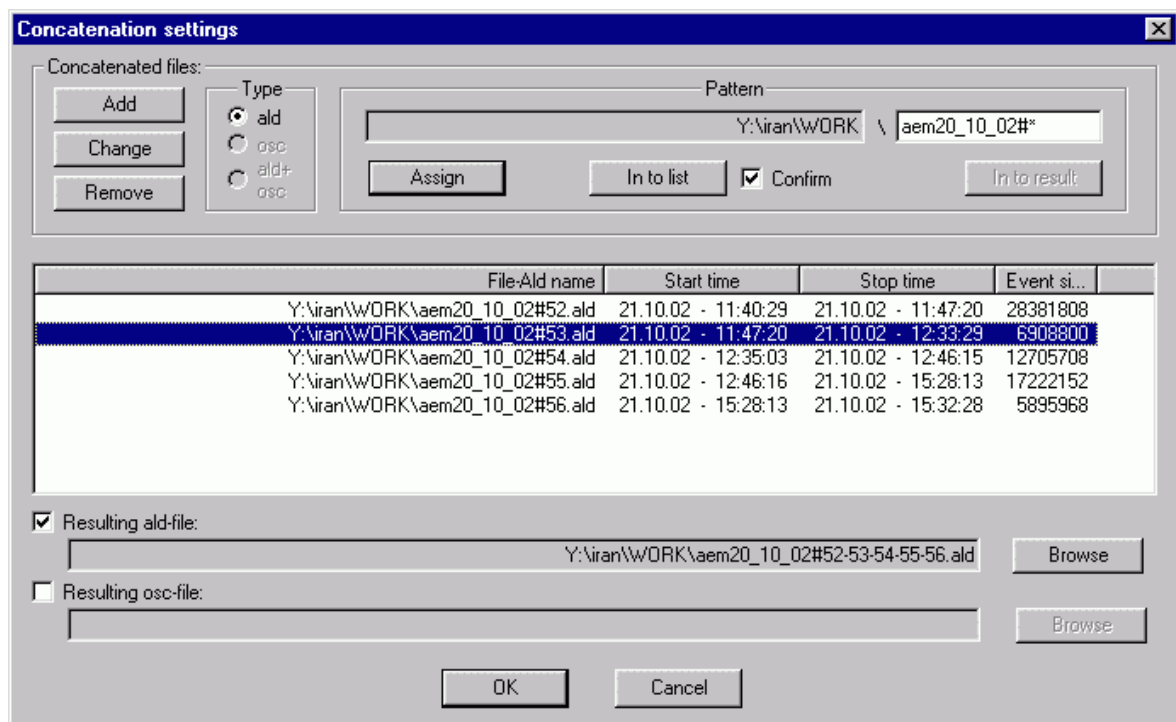


Fig. 3.4. **Concatenation settings** dialog box

- ◇ The names of the files merged should be specified in this dialog box.
 - Adding files to the concatenation list will be performed by pressing the **Add** button and random selection of the necessary files in the **File open** standard dialog box. At that, every file added will be automatically arranged in a certain sequence in the **File name** list with specifying the starting and the ending measurement time depending on the signal registration time.
 - For merging and selecting a multitude of files with similar names the program provides for possibility of specifying files by using a pattern which uses the '?' or '*' symbols, as described below in *“Using a pattern”*.
- ◇ For modification of the merged files list, the program provides for following possibilities:
 - For deleting a selected file, press the **Delete** button. If no definite file was selected, the total list will be deleted.
 - For changing a selected file, press the **Change** button.

The abovementioned operations become available after selecting one of the files in the concatenation list. Deletion and replacement operation will be performed for the file selected.

- ◇ For assigning the name to a result file, press the **Browse** button. Then, specify the name of the file for saving the merged data in the **Save as** standard dialog box.
- ◇ After specifying the file names press the **OK** button. The **Status bar** will display the process of file concatenation.

Using a pattern

For merging and selecting the multitude of files with similar names (e.g., the files of the same experiment, recorded in different time) the program provides for possibility of selecting files by using a pattern which uses the '?' or '*' symbols.

The '?' symbol substitutes any single symbol in the file name, the '*' symbol – any number of symbols in the file name. Thus, the Data?1 pattern corresponds to the files Data01, Data 11, DataB1 etc. The Data* pattern corresponds to files Data, Data1, Data 123, DataCB etc..

- ◇ Use the **Assign** button in the **Pattern** group for setting a pattern in the concatenation window. Select a source file for creating a pattern in the opened **File open** standard dialog box. Note that when necessary, the selected pattern can be edited.
- ◇ For filling in the list press the **In list** button. The file names satisfying the pattern and not intersecting in time will be added to the **File name** list. Otherwise, a message specifying the names of the files unsuitable for merging will be displayed.
- ◇ Activate the **Confirm** switch for confirming the file inclusion to the concatenation list and then press the **In list** button. After that, every time when the **Acknowledgment of accompaniment of file** dialog box appears, press the **Yes** button for file inclusion to the concatenation list or press the **No** button. When selecting the **Cancel** option, the program stops viewing the following file list. The previously selected files will remain in the list.
- ◇ After selecting the files for concatenation with the help of a pattern, you can specify the name of the result file. For this, use any of the following methods:

- press the **In result** button. The name of the result file offered by the program will be specified in the **Result files** field. It will be composed from the name of the pattern specified, including the differing parts for every merged file.
- select one or several files in the **File name** list. Then press the **In result** button. The name of the result file will be displayed in the **Result files** field. It will be composed of the name of the pattern specified, including the differing parts for every merged file.



In most cases a digit after '#' is substituted in the pattern for '*'. E.g., if you specify ...#0* (#1*, #2*...) in the pattern, the program will select the files for merging from ..#00 (..#10, ..#20) to ...#09 (..#19, ..#29..) correspondingly.

3.5. Project

In order to increase the convenience of working with files the program provides for creating a project combining different file types (data files, oscillograms, location, velocity measurement, load, settings), related to the examined object.

Creating a project

In order to create a project, use the **File-Project** main menu option. After that the **New Project Settings** dialog box will appear.

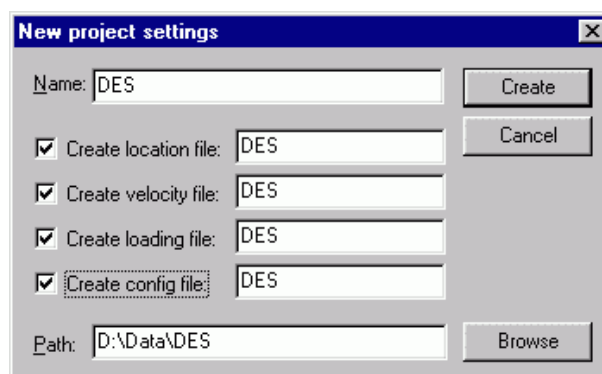


Fig. 3.5. **New Project Settings** dialog box

New project settings will be set in this dialog box.

- ◇ Enter the project name in the **Name** entry field. After that, it will be automatically assigned to all the files, included into the project.
- ◇ Specify the name of the folder where the created project will be located in the **Path** entry field. You can use the **View** button for selecting a folder. Specify the path for project in the opened **Select directory name** dialog box.
- ◇ Select the file types, which will be included in the project:
 - for using the location file set the **Create location file** switch;
 - for including the velocity file in the project set the **Create velocity file** switch;
 - in order to impose an additional line set the **Create loading file** switch;
 - for using the configuration file set the **Create config file** switch.

Press the **Create** button to create a project, after that, the project window will appear. For canceling the entered setting press the **Cancel** button.

Project Work Space

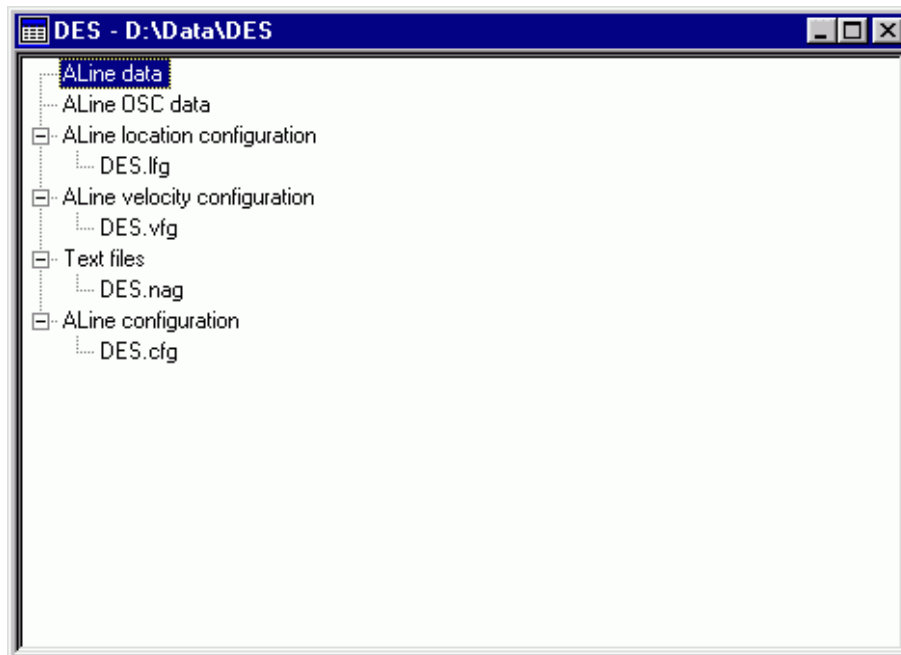


Fig. 3.6. **Project Work Space** box

All the files included in the project will be displayed in the project work space. For setting the parameters or changing them, move the pointer to the file name and click twice with the left mouse button. After that a corresponding dialog box will appear, where it is possible to enter the new parameters, or change the existing ones.

You can as well use the right mouse button instead of the left mouse button. By clicking the right mouse button once the context menu will be called.



Fig. 3.7. Popoup menu for project files

Option	Action
Open	Opens a corresponding file.
Edit	Opens the configuration window for changing the parameters of the corresponding file type.
Insert	Adds new file to the project.
Delete	Deletes selected file from the project.

Controlling the project work space

For opening an earlier created project use the **File-Open project** main menu option. After that the project work space appears, which can remain open during the data retrieval. It allows entering the necessary changes during the measurements.

For temporary closing the project work space use the **View-Project Work Space** main menu option. For restoring - select the **View-Project Work Space** main menu option again.

When necessary close the project work space by using the **File-Close project** main menu option.



Chapter 4. Data processing

- * Chapter “*Data processing*” describes operations on data - filtration, classification, printing and exporting.

4.1. Data filtering

Filtering parameters

The program allows performing data filtering after the following parameters:

- ◇ AEP number one after another - **Number**;
- ◇ AEP arrival time - **Time, [s]**;
- ◇ channel number - **Channel**;
- ◇ AEP maximal amplitude (expressed in conventional units or decibels) - **Amplitude, [ADC] / [dB]**;
- ◇ AEP energy (expressed in joules or decibels) – **Energy, [J] / [dB]**;
- ◇ AEP duration - **Duration, [mcs]**;
- ◇ AEP rise time - **Rise Time, [mcs]**;
- ◇ number of AEP threshold crossings (counts) - **Counts**;
- ◇ average AEP frequency (counts / duration) - **Counts / Dur., [kHz]**.

In addition to filtering after parameters you can perform filtering after optional flags:

- ◇ AEP maximal amplitude exceeds ADC maximal value - **Flag A**;
- ◇ AEP duration exceeds maximum level - **Flag D**;
- ◇ AEP has corresponding waveform saved - **Flag O**.

After performing location filtering additional parameters becomes available:

- ◇ location coordinates - **Loc. X, [mm]**, **Loc. Y, [mm]** and **Loc. Z, [mm]** (for 3D location only);
- ◇ location amplitude - **Loc. Amplitude, [dB]**;
- ◇ on the basis of the fact that an event was simultaneously located in different location zones - **Loc.******;
- ◇ clustering results - **Locations per cluster** (filtering of such location events, the number of which in a cluster fits the set range).

Except the data filtering after parameters the program provides for more complex filtering algorithms.

- ◇ Filtering after a formula, reflecting some functional dependency (linear, logarithmic etc.) of two parameters of every AEP.
- ◇ Filtering after the region.
- ◇ Filtering of synchronous interference.
- ◇ Filtering AEP packs.

Filter and review window

For viewing the data in the text mode, select the **File-Filter and review** main menu option. Then, select an ALD data file to view and filter in the **Open File** standard dialog box, and press the **Open** button. Then the **File Header** dialog box will open. By selecting the **OK** button in this dialog box, a file loading status window will be displayed. By selecting the **Cancel** button, the loading will not be performed.

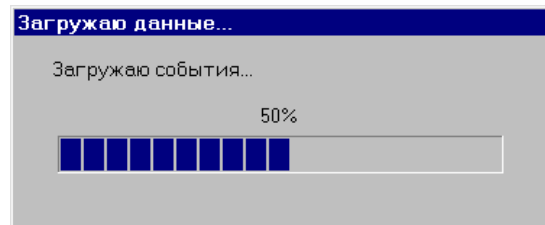


Fig. 4.1. File loading process

After the end of loading a window for viewing the file in the text form, where the data contained in the file will be represented appears. For viewing and filtering the currently opened file, use the **File-Filter current file** main menu option.

Every line in the view window corresponds to one AEP. The name of the file will be displayed in the window title. For better visualization the channel numbers are duplicated by colors.

N..	Date	Time	Channel	Amplitude, [mKV]	Amplitude, [dB]	Energy, [dB]	Duration, [mks]	Rise Time, [mks]	Counts	Flags
8	19.06.12	15:59:16.812729	03	1175.2	61.4	90.3	1	1	1	---
9	19.06.12	16:00:44.313035	01	29251.8	89.3	119.5	17125	26	1050	---
10	19.06.12	16:00:44.313041	03	22450.4	87.0	120.0	16925	34	1193	---
11	19.06.12	16:00:44.313087	02	20806.3	86.4	118.2	15450	37	770	---
12	19.06.12	16:00:44.329223	02	1485.7	63.4	95.5	456	455	4	---
13	19.06.12	16:00:44.331014	02	1297.0	62.3	91.2	2	1	1	---
14	19.06.12	16:00:44.331448	01	1120.4	61.0	92.5	1	1	1	---
15	19.06.12	16:00:44.331198	03	1686.7	64.5	98.5	1271	3	9	---
16	19.06.12	16:00:44.332680	01	1132.6	61.1	90.9	1	1	1	---
17	19.06.12	16:00:44.332882	02	1382.2	62.8	91.9	2	2	1	---
18	19.06.12	16:00:44.333993	03	1236.1	61.8	90.9	2	2	1	---
19	19.06.12	16:01:09.528380	01	1187.4	61.5	91.3	2	2	1	---
20	19.06.12	16:01:09.529115	02	1412.7	63.0	96.7	674	381	6	---
21	19.06.12	16:01:09.529353	01	1309.1	62.3	92.1	2	2	1	---
22	19.06.12	16:04:43.053241	01	9042.3	79.1	119.9	22550	73	674	---
23	19.06.12	16:04:43.053087	03	12933.2	82.2	121.1	23312	38	795	---
24	19.06.12	16:04:43.076368	01	1199.5	61.6	93.0	156	1	2	---
25	19.06.12	16:04:43.077516	03	1254.3	62.0	94.4	30	2	2	---
26	19.06.12	16:04:43.077466	01	1254.3	62.0	95.1	467	34	3	---
27	19.06.12	16:04:43.078445	03	1236.1	61.8	92.7	4	2	1	---
28	19.06.12	16:04:43.079804	01	1144.7	61.2	90.4	2	1	1	---
29	19.06.12	16:04:43.079523	03	1211.7	61.7	94.6	359	305	3	---
30	19.06.12	16:04:43.080701	03	1266.5	62.1	92.3	4	2	1	---
31	19.06.12	16:04:43.082627	01	1230.0	61.8	89.2	3	2	1	---
32	19.06.12	16:04:43.637374	03	1120.4	61.0	87.3	1	1	1	---

Fig. 4.2. Filter and Review box

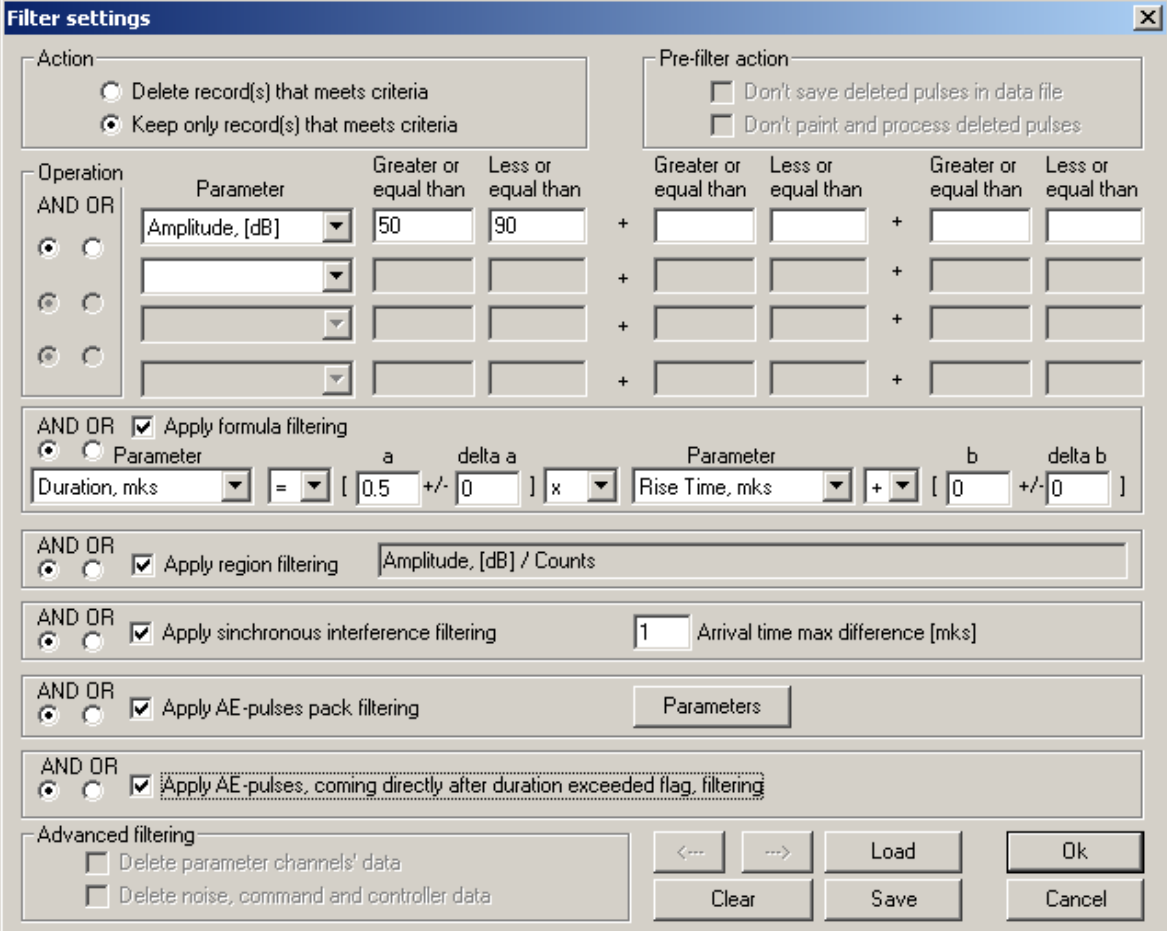
The data in the window for file viewing in the text mode is displayed in pages. The total number of pages in the file is shown in the **Total** field. For viewing the next page of the data, it is necessary to press the **Next** button, and for returning to the previous page – the **Prev** button. Every transition is followed by a window, displaying the loading process. For opening a file on arbitrary page, use the **Current page** list. The number of data lines displayed on a single page will be set in the **General Setup** dialog box.

- ◇ For sorting the data after some parameter within one page, press the button with this parameter's name in the events list header. The order for data sorting (increase or decrease) can be changed by pressing this button repeatedly. You can change the width and the order of columns by using the mouse.
- ◇ For loading the viewed data file in the program's graphics window interface, use the **Open** button. At that, the window for viewing the file in the text mode will remain open.
- ◇ File header can be viewed after pressing the **Header** button. After that, the **File Header** window, described in "*Opening a data file*" on page 24 will appear.
- ◇ The program provides for possibility of loading a new data file for viewing and filtering without closing the view window. For this, press the Load new button, select the necessary file in the **Open file** dialog box, and press the **Open** button. After that, press the **OK** button in the **File Header** dialog box.
- ◇ The data filtering can be performed by two methods: using the program filtering function and deleting the AEP strings manually.
 - For performing filtering with the help of the program, press the **Filter** button in the view window. More detailed information on setting the filtering conditions can be found below in "*Filtering*".
 - For manual AEP deletion, select the necessary AEP string and press the **Delete** button. For highlighting several lines, you can use the mouse or cursor buttons in combination with the **[Ctrl]** and the **[Shift]** buttons. If you want to save the data file with changes made, press the **Save as** button and specify the name of the file for saving the data in the **Save file** standard dialog box.
- ◇ The program provides for possibility of moving the highlighted lines to other Windows application thru the Clipboard (**[Ctrl-C]**, **[Ctrl-V]** key combinations).

The file view in the text mode window can be closed by pressing the **Close** button in this window.

Filtering

For performing the filtering, press the **Filter** button in the view window. After that the **Filter Settings** dialog box will appear.



The dialog box is titled "Filter settings" and contains several sections for configuring data filtering.

- Action:** Radio buttons for "Delete record(s) that meets criteria" and "Keep only record(s) that meets criteria".
- Pre-filter action:** Checkboxes for "Don't save deleted pulses in data file" and "Don't paint and process deleted pulses".
- Operation:** A section with radio buttons for "AND" and "OR", and a table for defining multiple filtering ranges.

Operation	Parameter	Greater or equal than	Less or equal than	+	Greater or equal than	Less or equal than	+	Greater or equal than	Less or equal than
<input checked="" type="radio"/>	Amplitude, [dB]	50	90	+			+		
<input type="radio"/>				+			+		
<input type="radio"/>				+			+		
<input type="radio"/>				+			+		
- Formula filtering:** Checkboxes for "Apply formula filtering" and "Parameter". A formula field shows: $\text{Duration, mks} = [0.5 \pm 0] \times \text{Rise Time, mks} + [0 \pm 0]$.
- Region filtering:** Checkboxes for "Apply region filtering" and "Amplitude, [dB] / Counts".
- Synchronous interference filtering:** Checkboxes for "Apply synchronous interference filtering" and "Arrival time max difference [mks]" (set to 1).
- AE-pulses pack filtering:** Checkboxes for "Apply AE-pulses pack filtering" and "Parameters".
- AE-pulses coming directly after duration exceeded flag, filtering:** Checkboxes for "Apply AE-pulses, coming directly after duration exceeded flag, filtering".
- Advanced filtering:** Checkboxes for "Delete parameter channels' data" and "Delete noise, command and controller data".

Buttons at the bottom include "<---", "--->", "Load", "Ok", "Clear", "Save", and "Cancel".

Fig. 4.3. Filter Settings dialog box

In this dialog box it is necessary to set the filtering conditions.

- ◇ Set the filtering criteria.
 - Select the parameter for performing the filtering in the **Parameter** list.
 - Specify the lower and the upper limit of the filtered parameter range in the **Greater or equal than** and **Lower or equal than** entry fields.

You can set up to three filtering ranges for every parameter.

Simultaneous filtering after several criteria (from one to four), combined by "**AND**" or "**OR**" logical conditions is permitted.

- ◇ Select the action on AEP records, satisfying the specified criteria in the **Action** group.
 - Set the **Delete record(s) that meets criteria** switch for deleting the data.
 - Set the **Keep record(s) that meets criteria** switch for saving the data.
- ◇ When necessary, set the additional filtering parameters.

After selecting all the necessary filtering conditions press the **OK** button. Specify the name of the file for saving the filtered ALD data in the **Save File** dialog box. After that, a window displaying the filtering process will appear.

After the end of filtering the program prompts for substituting the data in the view window by the data obtained in the result of filtering.

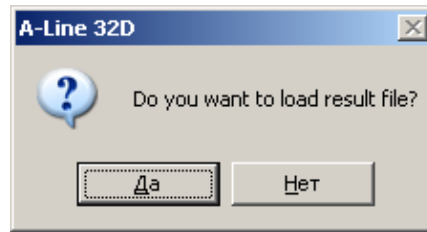




Fig. 4.4. Data substitution query

After pressing the **Yes** button, the data will be updated. In case you do not need to update the data, press the **No** button.

In case you need to continue the process of data filtering after other parameters, press the **Filter** button again. Set the new filtering conditions (or the ones you used before) in the opened **Filter Settings** dialog box and perform the filtering.

The program provides for possibility of saving and calling 20 set and used filtering conditions during the program operation. After performing just a single filtering process the  button will be available in the **Filter Settings** dialog box. It allows returning to previous filtering conditions. After the filtering process was performed several times, the  button will be available, allowing calling the next filtering conditions relative to examined conditions. For changing the previously set filtering criteria press the **Clear** button, and then enter the new criteria.

Formula filtering

The program provides for possibility of file filtering after the formula reflecting some functional dependency (linear, logarithmic etc.) of two parameters of every AEP.

In general, the formula for dependency between two AEP parameters has the following form:

Parameter1 {Relationship} ($a \pm \delta a$) \times Function(Parameter2) + ($b \pm \delta b$)

where:

- ◇ Parameter1 and Parameter2 are the AEP parameters;
- ◇ Relationship - ordering relationship (*equal, more, less, more or equal, less or equal*);
- ◇ $a \pm \delta a$ and $b \pm \delta b$ - coefficients;
- ◇ Function – the function (\times , $/$, \lg , \ln , \exp) determining the relationship.

For performing filtering after the formula set the **Apply formula filtering** switch in the **Filter Settings** dialog box, select the **"AND"** or **"OR"** logical condition and set the formula, reflecting the dependency of two AEP parameters in the group of filtering after the formula parameters.


When setting the formula it is necessary to:

- ◇ select the AEP parameters in the **Parameter** lists;
- ◇ select the ordering relationship in the corresponding list;
- ◇ - select the function type in the corresponding list;
- ◇ enter the value coefficients in the **a**, **b**, **delta a**, **delta b** entry fields.

Filtering after region

The program provides for possibility of performing the filtering after a region/polygon (region – is an area limited not only by straight lines, but also by arbitrary curves). This filtering type is applicable for correlation plot windows only (creation of correlation plot windows is described in “*Windows manager*” on page 72).

Prior to conducting filtering after the region it is necessary to select the region in the corresponding window graphically by performing the following actions:

- ◇ activate the window (if it is not active);
- ◇ press the  ("Polygon/Region") button on the **Toolbar**;
- ◇ draw a broken line fixing its vertices by clicking the left mouse button or draw an arbitrary line by moving the mouse with the left button pressed;
- ◇ enclose the region by placing the last point of the curve about the first point or by clicking the right mouse button in any place (at that the junction of the first and the last point will be performed automatically).

After the graphic selection of the region it is necessary to call the **Filter Settings** dialog box, set the **Apply region filtering** switch and select "**AND**" or "**OR**" logical condition.

Filtering of synchronous interference

For deleting/saving synchronous interference (inducing) it is necessary to set the **Apply synchronous interference filtering** switch in the **Filter Settings** dialog box, select the "**AND**" or "**OR**" logical condition and enter the maximum difference of the arrival time in the **Arrival time max difference, [mcs]** entry field.

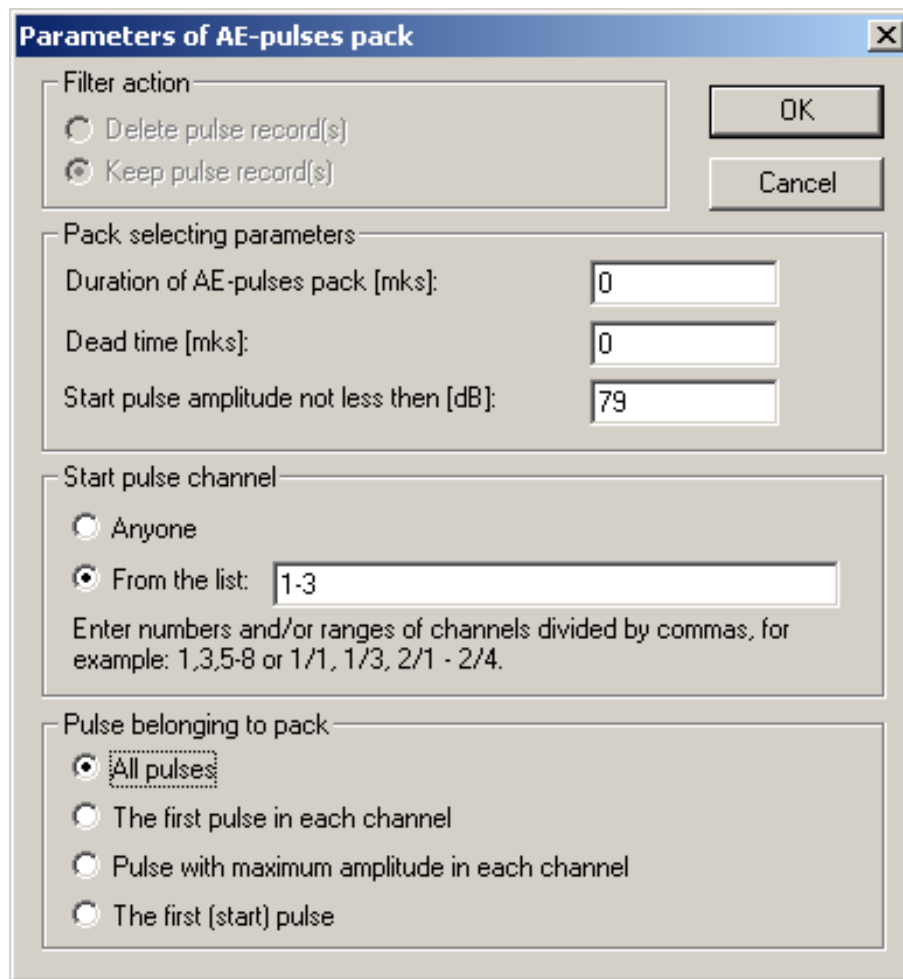
Note that usually the synchronous interference (inducing) for linear location type will be displayed on location diagrams in the form of columns located in the middle between the sensors. For plane location type they will be displayed either in the form of a point located in the center of a triangle (when noises arrive at three sensors), or in the form of a line, perpendicular to a triangle's side (when noises arrive at two sensors only). After filtering these columns/points (lines) will disappear. Contrary to similar filtering in the location filter, this noise is distinguished by the arrival time differences on all channels at once, irrespective of location groups.



This filtering type is applicable to data files, containing information on total number of events (i.e. obtained by version 4.56 or later) only. In case the file header does not contain this information, it is necessary to perform the preliminary filtering of this data file after any parameter, actually deleting nothing (e.g., delete the "*Amplitude, dB*" from 1 to 2 dB).

Filtering AEP packs

The program provides for possibility of performing the AEP packs filtering (AEP pack is a sequence of pulses, not less than two, which have arrival time difference that does not exceed the time interval set). For performing the AEP packs filtering set the **Apply AE-pulses pack filtering** switch in the **Filter Settings** dialog box; select the "**AND**" or "**OR**" logical condition and set the parameters of the AEP pack. For this, press the **Parameters** button. After that, the **Parameters of AE-pulses pack** dialog box will open.



The dialog box titled "Parameters of AE-pulses pack" contains the following sections:

- Filter action:** Two radio buttons: "Delete pulse record(s)" (unselected) and "Keep pulse record(s)" (selected). Buttons "OK" and "Cancel" are to the right.
- Pack selecting parameters:** Three text entry fields:
 - "Duration of AE-pulses pack [mks]:" with value "0"
 - "Dead time [mks]:" with value "0"
 - "Start pulse amplitude not less then [dB]:" with value "79"
- Start pulse channel:** Two radio buttons: "Anyone" (unselected) and "From the list:" (selected). Below "From the list:" is a text entry field containing "1-3". A note below reads: "Enter numbers and/or ranges of channels divided by commas, for example: 1,3,5-8 or 1/1, 1/3, 2/1 - 2/4."
- Pulse belonging to pack:** Four radio buttons:
 - "All pulses" (selected)
 - "The first pulse in each channel" (unselected)
 - "Pulse with maximum amplitude in each channel" (unselected)
 - "The first (start) pulse" (unselected)

Fig. 4.5. **Parameters of AE-pulses pack** dialog box

Set the AEP pack parameters in this dialog box.

- ◇ The **Filter action** group displays operations with pulses, set in the **Filter Settings** dialog box.
- ◇ Set the criterion for the pack selecting in the **Pack selecting parameters** group.
 - Enter the value of the AEP pack duration in the **Duration of AE-pulse pack, [mcs]** entry field.
 - Specify the value of dead time in the **Dead time, [mcs]** entry field (dead time is counted from the moment of the pack's duration end).
 - Set the amplitude value of the start AEP in the **Start pulse amplitude not less than, [dB]** entry field.
- ◇ Set the criterion for the start pulse channel of the pack in the **Start pulse channel** group.
 - Use the **Anyone** switch, or the **From the list** switch for selecting a channel. When activating the last switch it is necessary to enter the number and/or channel ranges in the corresponding entry field.
- ◇ Set the criterion for pulses forming the pack in the **Pulses belonging to pack** group.
 - In case of pack includes all the AEP, use the **All pulses** switch.

- In case of pack is formed from the first AEP on every channel, activate the **The first pulse in each channel** switch.
- In case of pack is formed from the AEP with maximum amplitude on every channel, use the **Pulse with maximum amplitude in each channel** switch.
- When filtering a pack of pulses, there is a possibility for leaving only the first (starting) pulse of the AE pack. For this, use the **The first (start) pulse channel** switch. The other pulses of the pack and the pulses not belonging to the packs will be deleted from the file.

After setting the parameters press the **OK** button. For canceling the changes, press the **Cancel** button.

Filtering of incorrect started pulses

For deleting/saving of incorrect started pulses coming immediately after one finished by Maximal duration reason and equipped by corresponding optional flag "D" it is necessary to set the **Apply AE-pulses, coming directly after duration exceeded flag, filtering** switch in the **Filter Settings** dialog box, select the "AND" or "OR" logical condition.

Additional filtering parameters

You can set the additional filtering parameters in the **Filter Settings** dialog box of the **Advanced Filtering** group.

- ◇ For deleting the data from parametric channels, contained in a data ALD file, set the **Delete parameter channels' data** switch.
- ◇ For deleting the noise, command and service controller data from the ALD file, set the **Delete noise, command and controller data** switch.

In case this window was called for setting the prefiltering parameters, the **Pre-filter action** group will become available.

- ◇ Set the **Don't save deleted pulses in data file** switch to prohibit saving the AEP, which did not pass through prefiltering.
- ◇ Set the **Don't paint and process deleted pulses** switch, in order not to display the deleted AEP on the diagrams and exclude them from the data taking part in location.

4.2. Classification

ALine 32D software products allows classification of AE sources after the danger level on the basis of Russian Government Standards or European Union Standard (only for amplitude criterion). According to the RS (Russian Standards of GosTechNadzor PB03-593-03), the discovered and identified AE sources are divided into four classes.

- ✧ I class source - passive source;
- ✧ II class source - active source;
- ✧ III class source – critically active source;
- ✧ IV class source – catastrophically active source.

According to the EN 14584:2005 standard the discovered and identified AE sources are divided into three classes.

- ✧ I class source - minor source. No further action shall be necessary.

- ✧ II class source - active source. Further NDT shall be recommended if the source is associated with specific parts of the pressure equipment;
- ✧ III class source – very active source. Further evaluation by other appropriate NDT shall be carried out before the pressure equipment goes into service;

The program allows using different criteria for dividing sources into classes.

Amplitude criterion



RS amplitude criterion

- ◇ IV class - $A \geq A_{\text{critical}}$, $N_A > A_{\text{critical}} \geq N_{\text{upper critical}}$
- ◇ III class - $A \geq A_{\text{critical}}$, $N_A > A_{\text{critical}} < N_{\text{upper critical}}$
- ◇ II class - $A < A_{\text{critical}}$, $N_A < A_{\text{critical}} \geq N_{\text{lower critical}}$
- ◇ I class - $A < A_{\text{critical}}$, $N_A < A_{\text{critical}} < N_{\text{lower critical}}$

where A is the registered location amplitude of the AE source;

A_{critical} - critical value of the parameter (set by operator);

$N_{\text{upper critical}}$ - upper critical of the parameter value (set by operator);

$N_{\text{lower critical}}$ - lower critical of the parameter value (set by operator);

$N_A > A_{\text{critical}}$ - the number of registered events with location amplitude higher than the critical value;

$N_A < A_{\text{critical}}$ - the number of registered events with location amplitude lower than the critical value;

EN amplitude criterion

- ◇ III class - $A \geq A_1$, $N_A \geq A_1 \geq N_1$
- ◇ II class - $A \geq A_2$, $N_A \geq A_2 \geq N_2$
- ◇ I class - $A \geq A_2$, $N_A \geq A_2 < N_2$

where A is the registered location amplitude of the AE source;

A_1 - first critical value of the parameter (set by operator);

A_2 - second critical value of the parameter (set by operator);

N_1 - first critical of the parameter value (set by operator);

N_2 - second critical of the parameter value (set by operator);

$N_A \geq A_1$ - the number of registered events with location amplitude higher than the first critical value;

$N_A \geq A_2$ - the number of registered events with location amplitude lower than the second critical value;

Prior to using the amplitude criterion for identification of the AE source danger level the location window should be open. Then select the **Classification-Amplitude criterion** main menu option. After that, the **Amplitude criterion setup** dialog box will open. To classify AE sources in terms of RS (PB 03-593-03) or EN 14584:2005 standards it is

necessary to select **PB 03-593-03** or **EN 14584:2005** radiobutton accordingly in the **Criterion variant according...** group.

The dialog box 'Amplitude criterion setup' has a title bar with a close button. It contains the following elements:

- A checked checkbox labeled 'Show classification results' with 'OK' and 'Cancel' buttons to its right.
- A group box 'Criterion variant according...' containing two radio buttons: 'PB 03-593-03' (selected) and 'EN 14584:2005'.
- A group box 'Parameters selection' containing two radio buttons: 'Auto' and 'Manual' (selected).
- A group box 'Object parameters' containing two dropdown menus: 'Sort of material:' and 'Object type:'.
- Three input fields at the bottom: 'A critical [dB]:' with value '90', 'N upper critical:' with value '3', and 'N lower critical:' with value '10'.

Fig. 4.6. Amplitude criterion setup in PB03-593-03 terms dialog box

The dialog box 'Amplitude criterion setup' has a title bar with a close button. It contains the following elements:

- A checked checkbox labeled 'Show classification results' with 'OK' and 'Cancel' buttons to its right.
- A group box 'Criterion variant according...' containing two radio buttons: 'PB 03-593-03' and 'EN 14584:2005' (selected).
- A group box 'Parameters selection' containing two radio buttons: 'Auto' and 'Manual' (selected).
- A group box 'Object parameters' containing two dropdown menus: 'Sort of material:' and 'Object type:'.
- Four input fields at the bottom: 'A1 [dB]:' with value '100', 'A2 [dB]:' with value '90', 'N1:' with value '3', and 'N2:' with value '10'.

Fig. 4.7. Amplitude criterion setup in EN 14584:2005 terms dialog box

In this dialog box it is necessary to set the parameters necessary for identification of the AE source danger level.

- ◇ Activate the **Show classification results** switch for displaying the results of the AE sources classification in the location window.
- ◇ Enter the corresponding values in the **A critical [dB]**, **N lower critical**, **N upper critical** entry fields in terms of the RS or in the **A1 [dB]**, **A2 [dB]**, **N1** and **N2** entry fields in terms of the EN.

After setting the parameters press the **OK** button, for canceling the selected parameters press the **Cancel** button. Classification results will be displayed in the location window.

Locally-dynamic criterion



This criterion characterizes the process of defects development in time depending on the loading parameter, i.e.

$$N \approx \alpha p(t)^n$$

where N is the number of registered events;

p - loading parameter;

n - exponent.

In this case the danger level of the AE source, according to RS, is classified in the following way:

- ◇ $0 > n > 1$ - danger source of the I class;
- ◇ $n \approx 1$ - danger source of the II class;
- ◇ $1 > n > 6$ - danger source of the III class;
- ◇ $n \geq 6$ danger source of the IV class.

Note that comparing with the amplitude criterion the locally-dynamic criterion is not connected with location.

Prior to using the locally-dynamic criterion for identification of the AE source danger level the ALD data file should be open. Then open the loading file (for this use the **Window-Additional lines** main menu option). After that, you can use the locally-dynamic criterion by selecting the **Classification-Locally-dynamic criterion** main menu option.

Then the **Locally-dynamic criterion power n / Time, [s]** window will open, where time will be laid on the **X**-axis, exponent of the locally-dynamic criterion - on the **Y**-axis (to the left), loading parameter value – on the **Y**-axis (to the right). Defects classification will be performed in the right part of the window.

S-H Diagram



Description and use of this criterion is given in RS (Regulations for organization and performance of acoustic emission testing of vessels, devices, boilers and industrial pipelines).

Prior to using the S-H diagram for identification of the AE source danger level the ALD data file should be open. Then use the **Classification – S-H diagram** main menu option. After that, the **File Header** dialog box will open for reading the data file.

After the end of the data loading, the **S-H Diagram** window will open, where a single point, being the result of calculations performed by the program, will be displayed. Depending on its position classification of the AE source danger level according to RS will be performed.

4.3. Printing

For printing the data use the **File-Print** main menu option. After that the **Print Setup** dialog dialog box will appear.

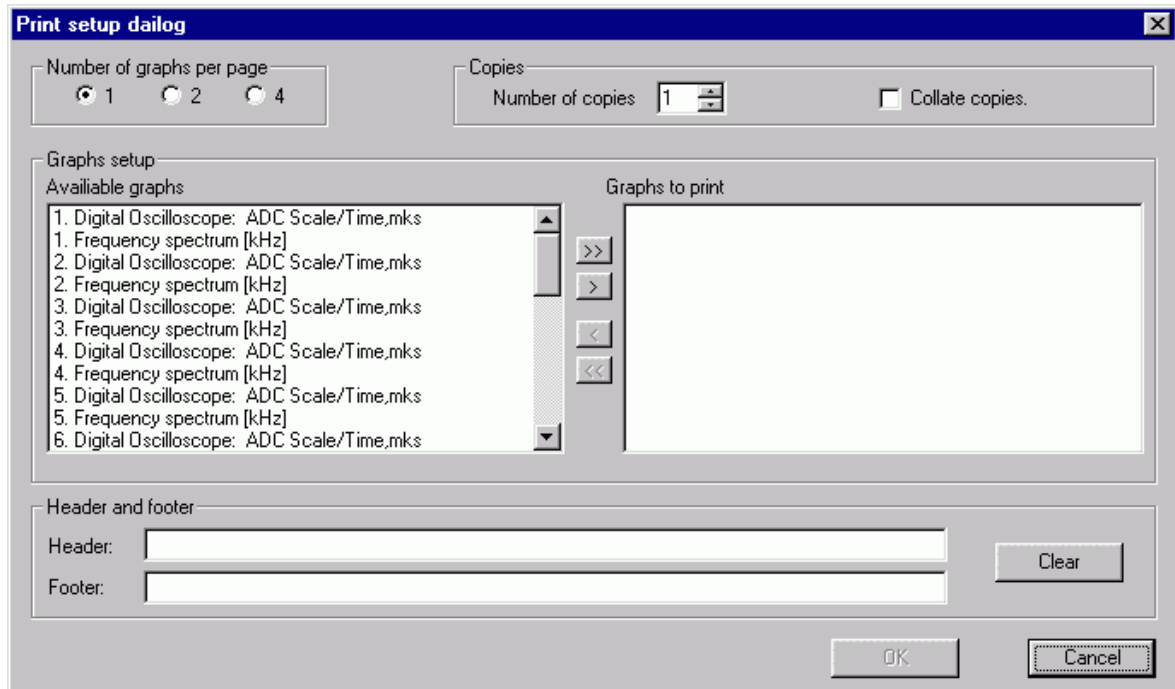


Fig. 4.8. **Print Setup** dialog dialog box

Print settings will be set in this dialog box.

- ◇ Number of diagrams placed on a single page can be selected by **1**, **2** and **4** switches in the **Number of graphs per page** group for one, two and four diagrams accordingly.
- ◇ Number of copies will be set by the **Number of Copies** spinner in the **Copies** group. The program allows printing from one to ninety-nine copies.
- ◇ Prints will be collated by setting the **Collate copies** switch in the **Copies** group.
- ◇ The **Header** and the **Footer** entry fields in the **Header and Footer** group are used for entering the header and footer values, correspondingly. The use of the **Clear** button will lead to header and footer deletion.
- ◇ You can select the diagrams for printing in the **Available Graphs** list. For this, provisions for several methods are made.
 - Double-click with the mouse on the name of the necessary diagram.
 - Select the necessary diagram by clicking on it with the mouse and press the **>** button.
 - For printing all the diagrams use the **>>** button.
 - Deletion from the list of printed diagrams will be performed similarly, i.e. by using the **<** and **<<** buttons correspondingly, and also by double-clicking in the **Graphs to print** list.

To start printing press the **OK** button, to cancel the selected settings – press the **Cancel** button.

Printer setup

Printer setup will be performed by selecting the **File-Printer Setup** main menu option.

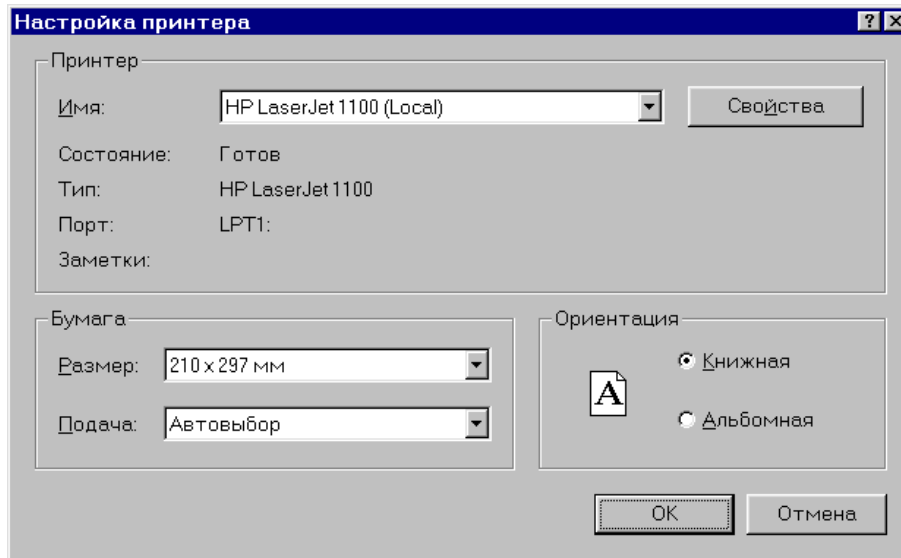


Fig. 4.9. **Printer Setup**

Then, the following can be selected in the **Printer Setup** dialog box:

- ◇ printer type;
- ◇ paper size and orientation;
- ◇ other printer-specific parameters.

Making a screen copy

In some cases, it may be necessary to make a screen copy and edit it in some other application.

For this, perform the following:

- ◇ activate the window, the image of which you want to obtain;
- ◇ set the necessary windows parameters (colors, scale, grid, dimensions);
- ◇ press the **Alt-Print Screen** key combination;
- ◇ open the graphics editor (or other application);
- ◇ use the **Edit-Paste** option.

4.4. Data export

A-Line32D software product allows converting (exporting) its data and oscillogram files to the text format, which can be used for working with other applications.

Exporting ALD data files

Data files conversion will be performed in the following way.

- ◇ Select the **File – Export ALD Data** main menu option.

- ◇ Select a data file in the opened **Open File** dialog box and press the **Open** button.
- ◇ Specify the name of the file for recording the exported data in the next **Save File** dialog box and press the **Save** button.

The indicator displaying the data conversion process will appear on the screen.

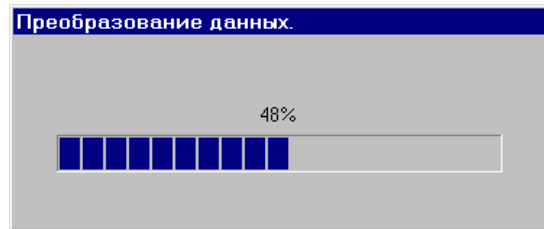


Fig. 4.10. Data conversion process

After the end of conversion this data box will disappear. Conversion time depends on the data volume in the file, therefore larger files may require more time for this process.

Exporting oscillogram files

Conversion of oscillogram files is similar to conversion of data files.

- ◇ Select the **File – Export OSC Data** main menu option.
- ◇ Select an oscillogram file in the opened **Open File** dialog box and press the **Open** button.
- ◇ Specify the name of the file for recording the exported oscillograms in the next **Save File** dialog box and press the **Save** button.

The indicator displaying the oscillogram conversion process will appear on the screen. After the end of conversion this data box will disappear. Conversion time depends on the number of oscillograms in the file, therefore, for large quantity of oscillograms this process may require more time.



Chapter 5. System Parameters Setup

* Chapter “*System Parameters Setup*” tells how to configure the system.

5.1. Saving and loading configuration files

For opening a configuration file select the **File – Open Config** main menu option. After that the **Open File** dialog box will appear, where it is necessary to select the file configuration and press the **Open** button.

For saving a configuration file, use the **File – Save Config** main menu option. In case the file with the name specified already exists, the system prompts for rewriting the file. When pressing the **Yes** button the settings will be saved in the file specified. When pressing the **No** button, the system displays the **Save File** dialog box, where the new file name should be specified. After that press the **Save** button. In case the file with the name specified does not exist, it will be recorded, otherwise the system prompts to confirm overwriting of the selected file.

Provisions are made for saving the new measurement settings (such as time parameters, saving parameters, pre-filter parameters, general information) and postprocessing windows settings in a configuration file. Use the **File-Save Config** main menu option for saving these settings, and the **File – Open Config** main menu option for calling the previously saved settings.

5.2. General information

The main menu has the following options for setting the channel parameters:

- ◇ **Options – Channels parameters;**
- ◇ **Options – OSC parameters;**
- ◇ **Options – Time definition;**
- ◇ **Options – Calibrator parameters (for DDM systems type only);**
- ◇ **Options – Parameters settings.**

The **Options – Channels parameters** and the **Options – OSC parameters** main menu options are also duplicated by pictographic menu buttons. After selecting one of these options the **Channels settings** dialog box, opened at the corresponding **Main Settings**, **Oscilloscope**, **Time Definitions**, **Calibrators settings** (for DDM systems type only), **Additional settings** (for PCI systems type only) or **Parametric Inputs** page will appear.

The **Channels parameters** dialog box is multipage. It is used for the main channels parameters setting for the AEP registration (**Main Settings** and **Time Definitions** page), oscilloscopic channels parameters (**Oscilloscope** page), calibrators settings (**Calibrators settings** page), preamplifier gains settings (**Additional settings** page) and parametric channels settings (**Parametric Inputs** page).

The data on every page is represented in the listview window by a number of lines with indicating the corresponding line and channel number. In case a window opened contains a scroll bar, it means, that all the data does not fit the visible part of the screen and when necessary you should use the scroll bar for selecting the necessary data.

Working with data begins from selecting a line (block or separate lines). For this, it is necessary to move the pointer to the necessary line and click the mouse button. When selecting a block, use the **Shift** button and, by holding it, select the first and the last lines of the data in the block as described above. In order to select separate lines use the **Ctrl** button and the mouse pointer. Move the pointer to a line and click the left mouse button. After selecting a line the data of parametric channels will be displayed in the corresponding dialog box elements. When selecting data block or separate lines the parameters values will also be displayed in the dialog box elements, in case these values are equal for all the channels. Otherwise, the parameter value will not be available. Note, that it is not necessarily the case for after selecting a line (block or separate lines) and displaying the parameter values in the display box elements the display box elements themselves will be activated (i.e. available for correcting the data).

Data correction on the dialog box page is not available in the file reading mode, excluding several parameters, related to the results display (e.g., channel color selection). This procedure is only available during the preparation for data collection mode and in the data collection mode after the hardware have been powered. The hardware power will be performed after calling the **Measurement details** dialog box for the first time (**Control – New measurement** option) and after the operator confirms the "**Attention! Turn power on?**" command.

After hardware powering and selecting the data (line, block or separate lines) all the dialog box elements (lists, entry fields, spinners), located in the lower part, will be available and correction of parameters will be available. For this, it is necessary to select the necessary value of some parameter in the corresponding dialog box element, after which it will be assigned to all the similar parameters of the data selected.

Using the spinners for changing the data in the selected line leads to increasing/decreasing its values within the set limits. Changing data in a block (selected lines) with different parameter values by using a spinner will be performed in a following way: increase will be performed from the minimum parameter value in the block (in selected lines), and the decrease – from the maximum value.


When making corrections in the entry fields in case of erroneous data entry, default parameter values can be restored. For this, clear the entry field (**Del** or **Back Space** keys), after which the initial value of the given parameter for the data selected will appear in the data view window. In case after entering the new parameter value the mouse pointer was moved to any other dialog box element, it will be assigned to the corresponding parameters in the data selected (in case of allowable value of the parameter entered), or the **Input error** will appear (in case of exceeding the allowable value range).

For simultaneous setting of the parameters on all the channels, it is necessary to use the **Select all** button, available on every page. Then set the parameters values, which should be assigned to all the channels.

For switching to other dialog box pages it is necessary to move the mouse pointer to the corresponding inlay and click the left mouse button (or use the **Ctrl+Tab** key combination). Channel (channels) selection will be saved when switching to other pages.

After setting the parameters on all the pages, press the **OK** button. For canceling, press the **Cancel** button. Note that the **Cancel** button cancels changes on all the pages.

5.3. Setting the main channel parameters

For setting the main channel parameters select the **Options – Channel parameters** main menu option or press the button  on the **Toolbar**. After that the **Channels settings** dialog box, open at the **Main settings** page will appear.

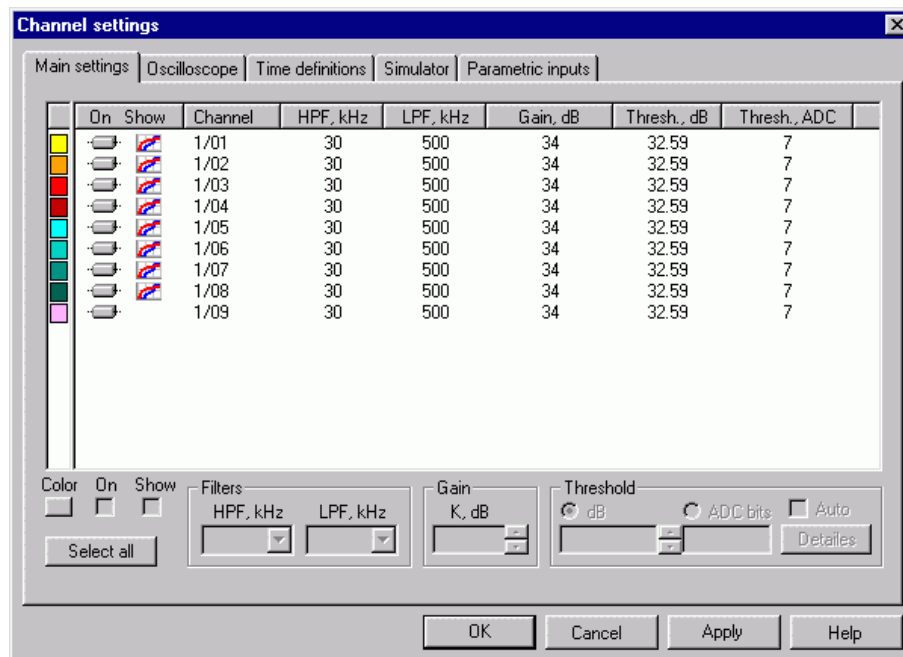


Fig. 5.1. **Channels settings** dialog box, **Main settings** page

Main channel parameters will be set at this page.

- ◇ Switch on/off the channels and display of the data from these channels by **On** and **Show** switches correspondingly.
- ◇ Frequencies for the high frequency filter (HPF) and the low frequency filter (LPF) should be selected in the **HPF, kHz** and the **LPF, kHz** lists in the **Filters** group correspondingly (for DDM systems type only). Frequency belt filter (HPF - LPF) should be selected in the **HPF, kHz LPF, kHz** lists in the **Filters** group correspondingly (for PCI systems type only).

Note that when selecting the frequencies for the **HPF** and the **LPF** it is necessary to take into consideration the fact that the value of the frequency for the **LPF**, should be at least twice more than the frequency value for the **HPF**. In case this condition is not met, the program will change the frequency values independently.

- ◇ Amplification on channels should be set by the **K, dB** spinner in the **Gain** group (for DDM systems type only).

Changing the amplification coefficient values will also lead to changing the threshold values. This follows from the formula, connecting these values:

$$\text{Threshold[dB]} = 20 \lg (\text{Threshold[ADC units]} * D / \text{Support}) - \text{Gain, dB},$$


where

D - is the parameter defining the channel's ADC,

Support - basic scale value for conversion of the obtained values of the AEP amplitude to dB. The value of this parameter will be set in the **General settings** dialog box (**Options – Settings**).

At that, in case the **dB** switch the **Threshold** group is activated, the system will be trying to select such a value of the ADC units, for which the threshold value in dB would remain the same as before, as much as possible.

When activating the **ADC bits** switch, the threshold value in the ADC units will remain unchanged, and the threshold value in dB will change after the corresponding recalculation performed by the program.

- ◇ By using the spinner, set the discrimination threshold in the **Threshold** group.
When activating the **dB** switch the change of the threshold value will be represented by two values – a fractional value and an integer quantity (integer quantity specified in brackets). Such a representation of the threshold in dB value change will be related to operation of the program, which will be selecting the value of the threshold in ADC units in such a way, that the sampling increment would be equal to ~1dB (this value specified in brackets). The fractional value will display the value, maximally close to the value in brackets from among those available. When activating the **ADC bits** switch, the sampling increment will be equal to 1 ADC unit.
- ◇ The program provides for possibility of assigning the threshold value automatically. For setting the autothreshold mode, activate the **Auto** switch in the **Threshold** group. This switch will be available in the **On-Line** mode only. After that, the threshold value selected by the program will be automatically assigned to all the channels. The process of assigning the autothreshold value will be described below. In order to select the autothreshold mode you can as well use the **Control – AutoThreshold** main menu option or the button  on the **Toolbar**.
After setting the parameters, press the **OK** button. From this moment, the values set will come into force. For canceling the parameters setting, press the **Cancel** button. For applying the new parameters without exiting the **Channels setting** dialog box the **Apply** button is used.
- ◇ For changing the color for displaying the obtained data on channels, use the **Color** button.
The color will be selected with the help of the **Color** standard dialog box.

Setting the autothreshold parameters

For setting the autothreshold value, press the **Details** button in the **Threshold** group. After that the **Auto threshold parameters settings** dialog box will appear. In this dialog box set parameters for specifying the autothreshold value.

- ◇ Use the **Noise pack buffer length** spinner for setting the noise packs averaging buffer.
- ◇ Set the threshold value exceeding the average noise level in the **Install threshold, that exceeds averaged noise level by** field in dB.
- ◇ Enter the minimum threshold value in the **Minimum threshold level** field in ADC bits.
- ◇ Enter the value of the threshold increase per second under condition of the noise packs absence in the **In case of the noise packs absence increase threshold level by** field in dB.

- ◇ Enter the value of the new threshold, in case this value differs from the previous in the **Install new threshold level only if it exceeds old one not less than by** field in ADC bits.

After setting the parameters, press the **OK** button. For canceling the changes made in the **Auto threshold parameters settings** dialog box, press the **Cancel** button.

We recommend keeping the parameter values set in the program, excluding the case of specific peculiarities of the examined object.

5.4. Channel time parameters setup

Select the **Options – Time definitions** main menu option for setting the channel time parameters. After that, the **Channels settings** dialog box, open at the **Time definitions** page will appear.

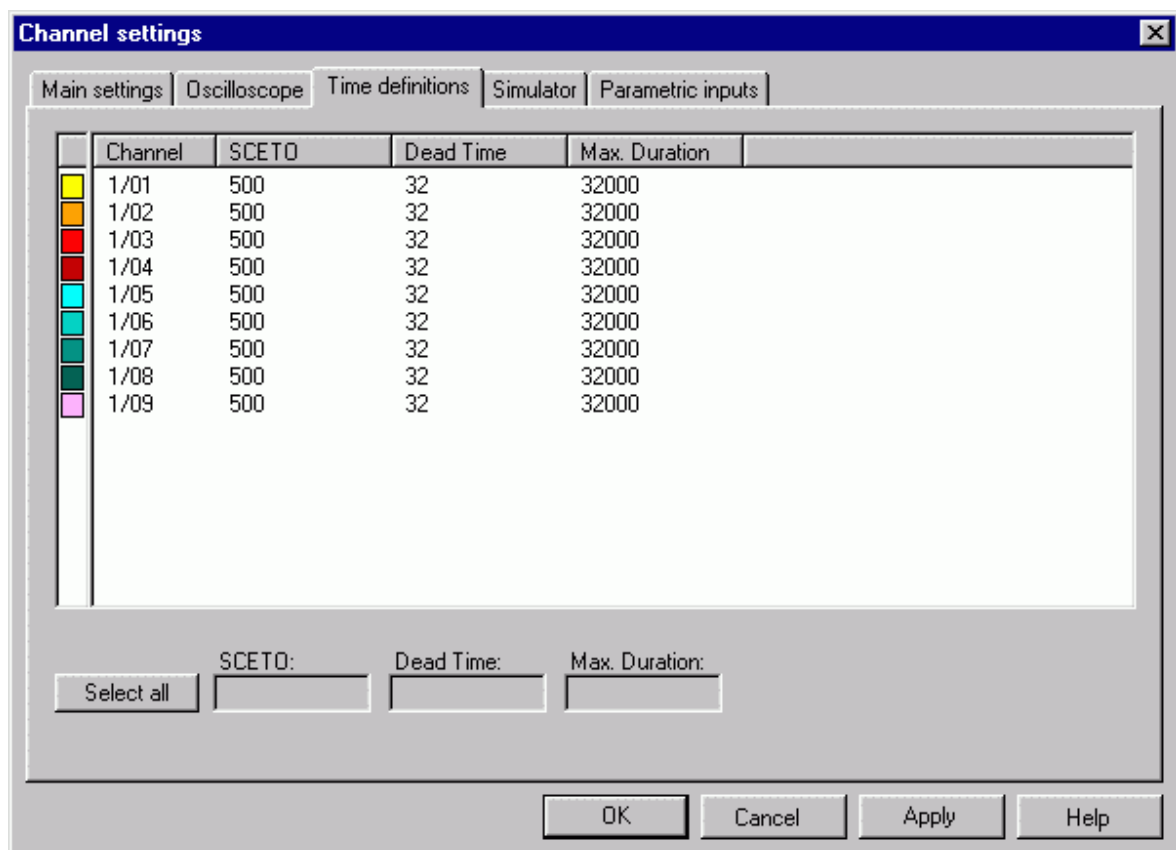


Fig. 5.2. **Channels settings** dialog box, **Time definitions** page


Channel time parameters will be set at this page.

- ◇ Enter the value of the **SCETO** parameter in the **SCETO** entry field in mcs.
- ◇ Enter the value of the **Dead time** parameter in the **Dead Time** entry field in mcs.
- ◇ Enter the value of the **Maximal duration** parameter in the **Max. Duration** entry field in mcs.



For all the time constants (**SCETO**, **Dead time**, **Maximal duration**) the value range changes from 1 to 65535 mcs.

5.5. Oscilloscope channels setup

For setting the Oscilloscope channels (oscilloscope) parameters select the **Options – OSC parameters** main menu option or the pictogram . After that, the **Channels settings** dialog box open at the **Oscilloscope** page will appear.

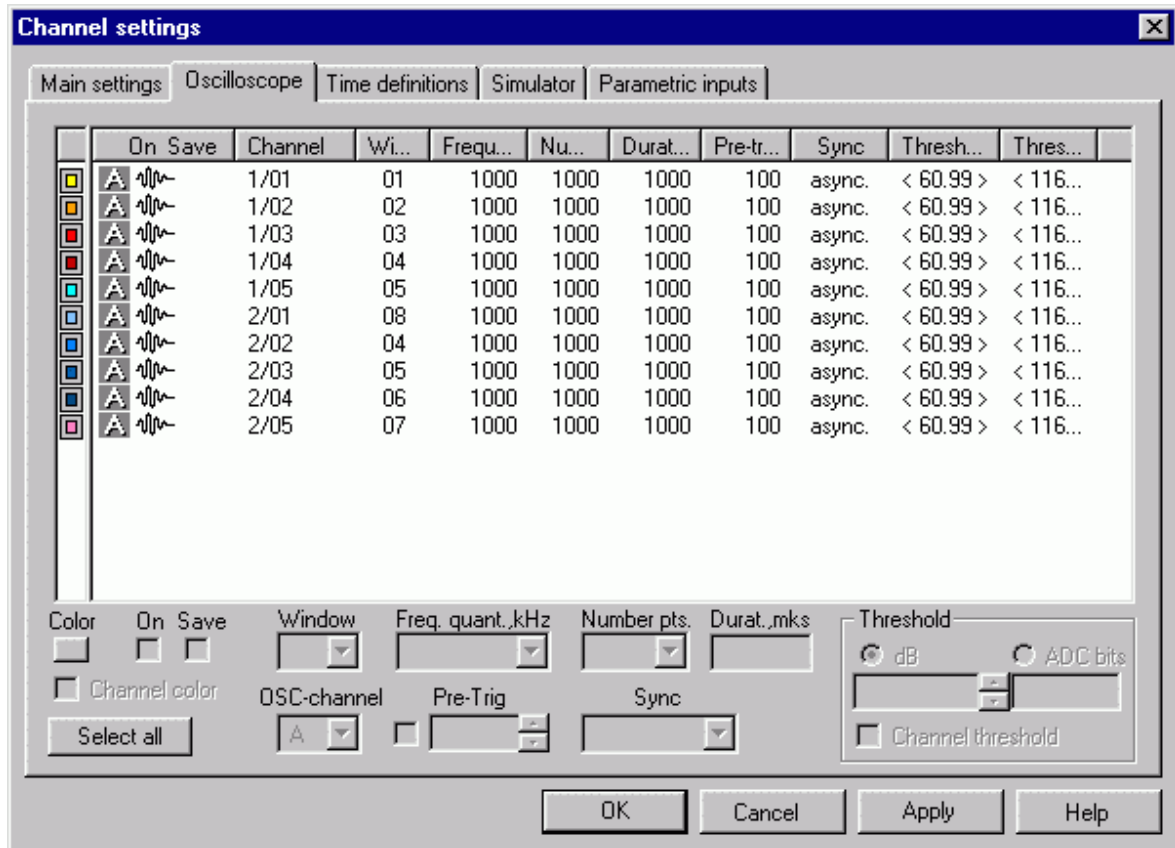


Fig. 5.3. **Channels settings** dialog box, **Oscilloscope** page.

Oscilloscope channels parameters will be set at this page.

- ◇ For switching selected oscilloscope channel on or off, use the **On** switch.
- ◇ For saving the data from selected oscilloscopic channel activate the **Save** switch.
- ◇ Select the number of the window for displaying the data from selected oscilloscope channel in the **Window** list.
- ◇ Select the sampling frequency (in kHz) in the **Freq.quant, kHz** list.
- ◇ Specify the number of points in the oscillogram in the **Number pts** list.
- ◇ Duration of the oscilloscope frame will be calculated by the program and its value will be displayed in the **Durat.,mcs** field.

The formula for calculation of the scanning duration is the following:

$$\text{Duration, mcs} = (\text{Number of points} / \text{Sampling frequency, kHz}) \times 1000$$

- ◇ Set the number of points in an oscilloscope frame, containing some prehistory of the AEP by using the **Pre-Trig** spinner. To switch pre-triggering mode on or off use switch in this group.

- ◇ Set the type of oscilloscope channel synchronization by selecting corresponding string in the **Sync** listbox (for PCI systems type only).

Available synchronization modes are:

- **async** - asynchronous mode: all channels start independently;
 - **master** - master mode: selected channel starts by himself and starts all slave channels synchronously;
 - **slave** - slave mode: selected channel starts only in case of any master channels starts synchronously;
 - **master/slave** - master/slave mode: selected channel acts as master and slave simultaneously;
- ◇ The oscilloscope individual threshold will be specified in the **Threshold** group.
 - Set the value of the oscilloscope threshold by using the spinner in the **Threshold** group, similar to as described for the **Main Settings** page.
 - In case the oscilloscopic channel threshold value corresponds to the corresponding AE data channel value, activate the **Channel threshold** switch in the **Threshold** group.

After that, the threshold value in the **Threshold, dB** and the **Threshold, ADC bits** columns in the view field will be displayed in brackets.

- ◇ For changing the color for displaying the data obtained on oscilloscopic channels, use the **Color** button. The color will be selected by using the **Color** standard dialog box.
- ◇ For representing the oscilloscopic channel data in the same channel's color as the data of the corresponding AE data channel, activate the **Channel color** switch.

After activating it, it will not be possible to change the color of the selected oscilloscopic channel on the **OSC** page by using the **Color** button. When it is necessary to change the colors, return to the **Main settings** page and select the necessary color by using the **Color** button, or reset the **Channel color** switch at the **OSC** page.

5.6. Setting the parametric channels

For setting the parametric channels select the **Options – Parameters settings** main menu option. After that, the **Channel settings** dialog box, open at the **Parametric inputs** page will open.

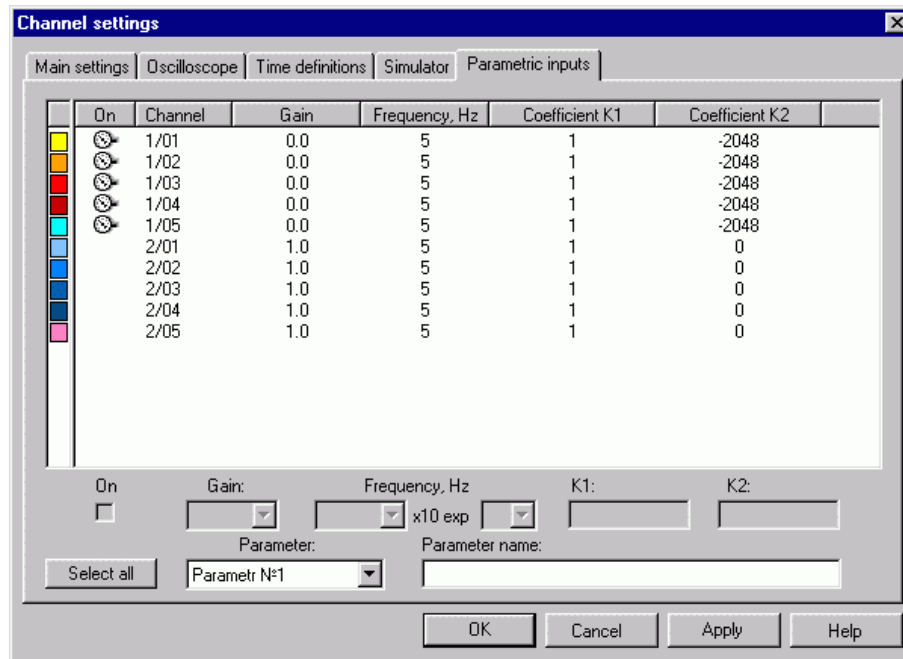


Fig. 5.4. **Channel settings** dialog box, **Parametric inputs** page.

Parametric inputs setup will be performed at this page.

- ◇ For switching parametric channels use the **On** switch.
- ◇ Specify the amplification coefficient value in the **Gain** list (reserved for future use).
- ◇ Select the parametric channel frequency values in the **Frequency, Hz** list (reserved for future use).
- ◇ Specify the **K1** and **K2** coefficients values in the **K1** and **K2** entry fields.
- ◇ The parameter value in physical units will be set by **K1** and **K2** dimension factors after the following formula:

$$\text{Parameter (physical units)} = K1 \times \text{Parameter (ADC units)} + K2$$
- ◇ Parameter selection and name will be set in the **Parameter** list and in the **Parameter name** entry field, correspondingly. Note that the **Parameter** list and the **Parameter name** entry field will be available after opening the **Parametric inputs** page. These parameters are common for the whole system.

For simultaneous parameters setup similar for all the channels use the **Select all** button.

5.7. Setting the calibrators parameters (for DDM systems type only)

For setting the calibrators parameters select the **Options – Calibrators parameters** main menu option. After that, the **Channel settings** dialog box, open at the **Calibrators parameters** page will appear.

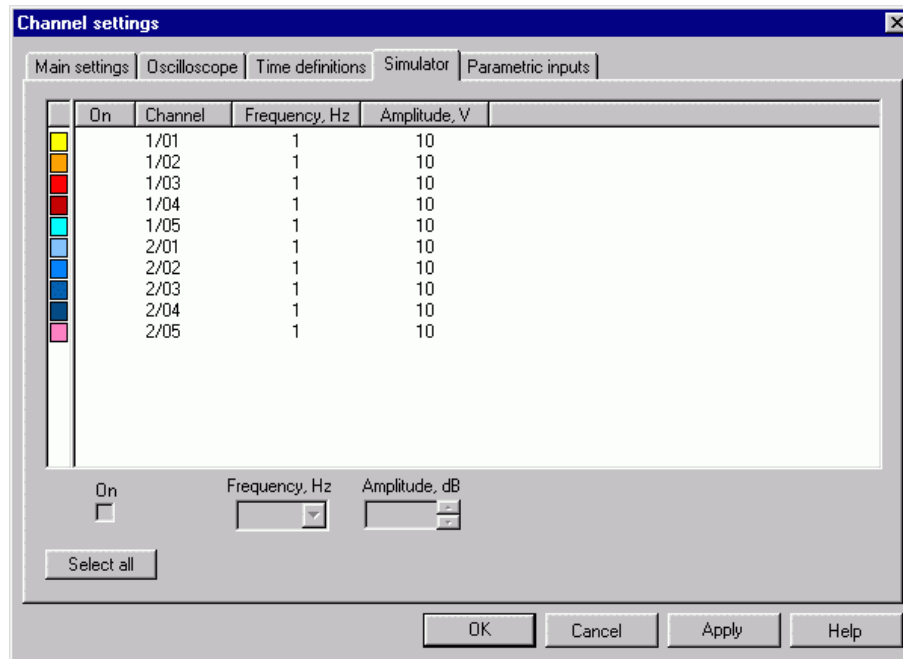


Fig. 5.5. **Channel settings** dialog box, **Calibrators parameters** page

Calibrators parameters will be set at this page.

- ◇ For switching the calibrators on and off use the **On** switch.
- ◇ Select the pulse-repetition frequency of the impulses, emitted by the calibrator in the **Frequency, Hz** list.
- ◇ Set the amplitude of the impulses, emitted by the calibrator with the help of the **Amplitude, V** spinner.



When switching the calibrator on the corresponding AE data channel will be switched off.

For simultaneous setup of the parameters similar for all the channels, use the **Select all** button.

Note that the **Simulator** page is available for DDM systems type only.

5.8. Additional parameters setting (for PCI systems type only)

For setting the additional parameters select the **Options – Channels parameters** main menu option. After that, the **Channel settings** dialog box, open at the **Main settings** page will appear. Then choose **Additional settings** page to set additional parameters

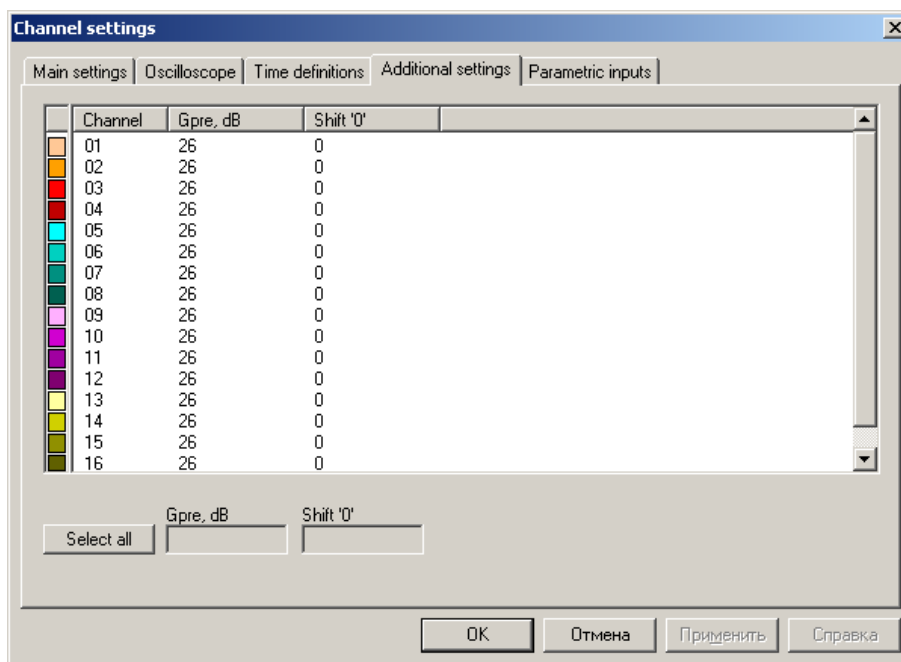


Fig. 5.6. **Channel settings** dialog box, **Additional settings** page

Additional parameters will be set at this page.

- ◇ To set connected preamplifier gain in dB use the **Gain, dB** entry field.
- ◇ To change ADC '0' shift in ADC units use the **Shift '0'** entry field.

For simultaneous setup of the parameters similar for all the channels, use the **Select all** button.

Note that the **Additional settings** page is available for PCI systems type only.

5.9. Setting general system parameters

Setting the general system parameters will be performed by selecting the **Options-Settings** main menu option. As a result, the **General settings** dialog box will appear. This dialog has several pages devoted to the different advanced system setup:

- ◇ **General settings** page contains different general settings options.
- ◇ **Network connection** page contains network settings for the Enhanced Ethernet Box system type hardware.
- ◇ **Export parameters** page contains settings for the ALD-file export.
- ◇ **Parameters list** page contains the lists of the AEP parameters need to presented into the text view windows.

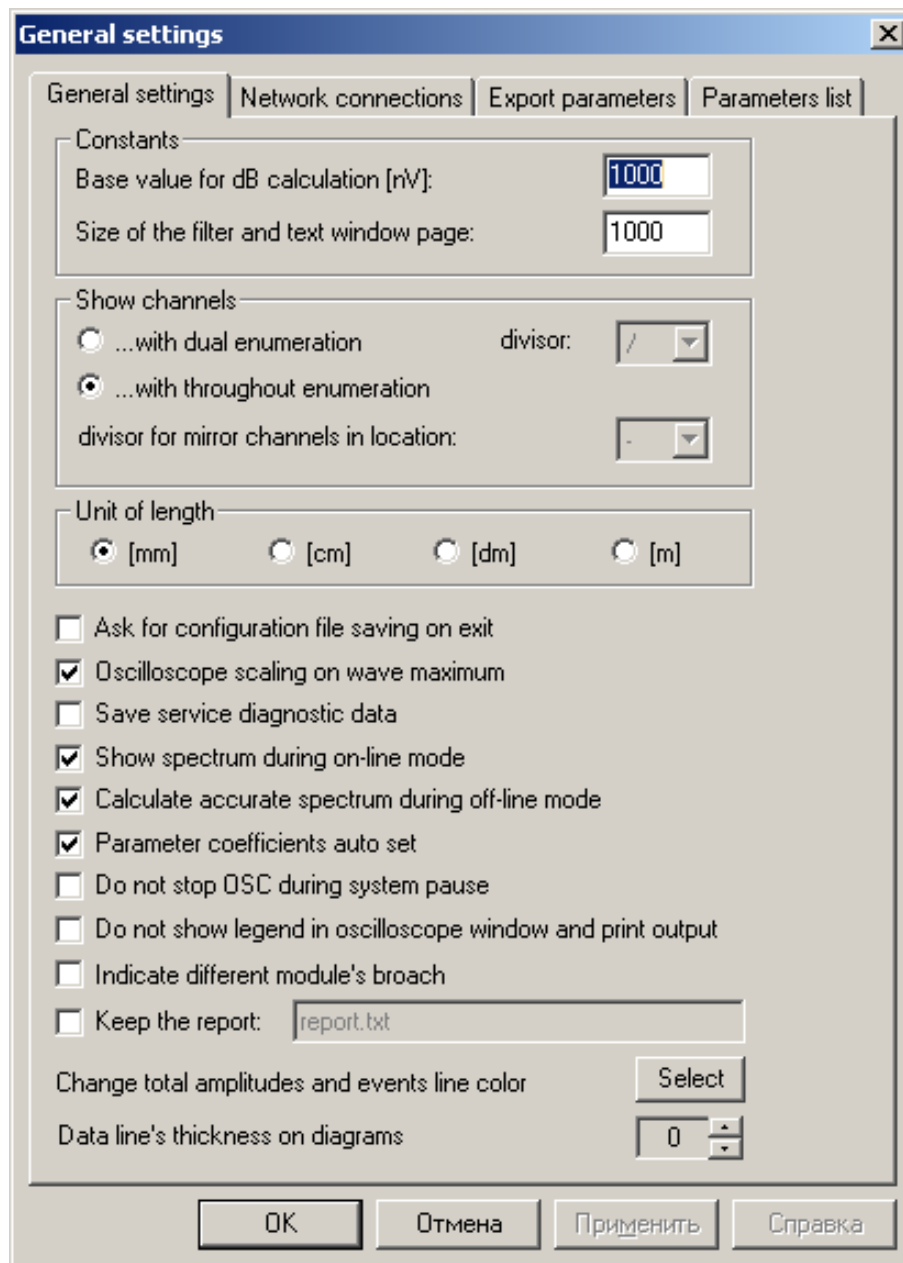


Fig. 5.7. **General settings** dialog box. **General settings** page

In the **General settings** dialog page the parameters are divided into several groups as well as represented by a series of switches.

- ◇ The **Constants** group represents the assignable values, which are constant for the whole system:
 - basic scale value for calculation of the obtained AEP different amplitude values into dB, in nano-volts unit in the **Base value for dB calculation, [nV]** entry field (default value, 1000 nV).
 - Number of strings in the text view page – in the **Size of the filter and text window page** entry field.
- ◇ The **Show channels** group contains information on channels numbering selection:

- the use of the dual numbering – the **...with dual enumeration switch**. (When using the dual numbering the first digit represents the line/board number and the second digit represents the number of the channel in this line/board).
 - divisor selection (/, \, -, --) when using the dual channels numbering – in the **Divisor** list.
 - the use of the throughout enumeration for channels display – the **...with throughout enumeration switch**.
 - divisor selection for location mirror channels – in the **Divisor for mirror channels in location** list. Available only at open location windows.
- ◇ The **Unit of length** group contains information about any sizes, lengths and other geometry parameters unit selection:
- to set all sizes in millimeter unit – the **mm** switch should be selected.
 - to set all sizes in centimeter unit – the **cm** switch should be selected.
 - to set all sizes in decimeter unit – the **dm** switch should be selected.
 - to set all sizes in meter unit – the **m** switch should be selected.

The program also provides for the following possibilities:

- ◇ saving a configuration file on exit of the program – the **Ask for configuration file saving on exit switch**;
- ◇ scaling oscilloscope windows on the basis of the maximal waveform amplitude value automatically – the **Oscilloscope scaling on wave maximum**;
- ◇ scaling oscilloscope windows on the basis of the maximal waveform amplitude value automatically – the **Oscilloscope scaling on wave maximum**. Otherwise, the scaling will be performed after the full ADC scale.
- ◇ to store the service diagnostic data in ALD data file – the **Save service diagnostic data** switch.
- ◇ performing spectral analysis in the data collection mode – the **Show spectrum during on-line mode** switch.
- ◇ calculation of the more precise spectrum in the postprocessing mode – the **Calculate accurate spectrum during off-line mode** switch.

When activating this switch, the real taken oscillogram wave will be extended due to filling the buffer with zero amplitude points and the calculation of such more precise spectrum will be performed.

- ◇ setting the default parametric channels coefficients – the **Parameter coefficients auto set** switch.
- ◇ to continue oscilloscope function during system paused period – the **Do not stop OSC during system pause** switch.
- ◇ to remove color legend from the oscilloscope windows and print out – the **Do not show legend in oscilloscope window and print output** switch.
- ◇ to allow warning message output about different channel's broach – the **Indicate different module's broach** switch (for DDM type system only).
- ◇ to keep the history report in file – the **Keep the report** switch and input filename into the entry field (default filename: report.txt).

- ◇ selection of the line color on the total parameters diagrams will be performed with the help of the **Color** standard dialog box. For opening it, use the **Select** button. For opening it, use the **Select** button.
- ◇ to change the data line thickness onto the graphics use spin controls onto **Data line's thickness on diagrams** entry field. The minimal thickness is 0 units (default value).

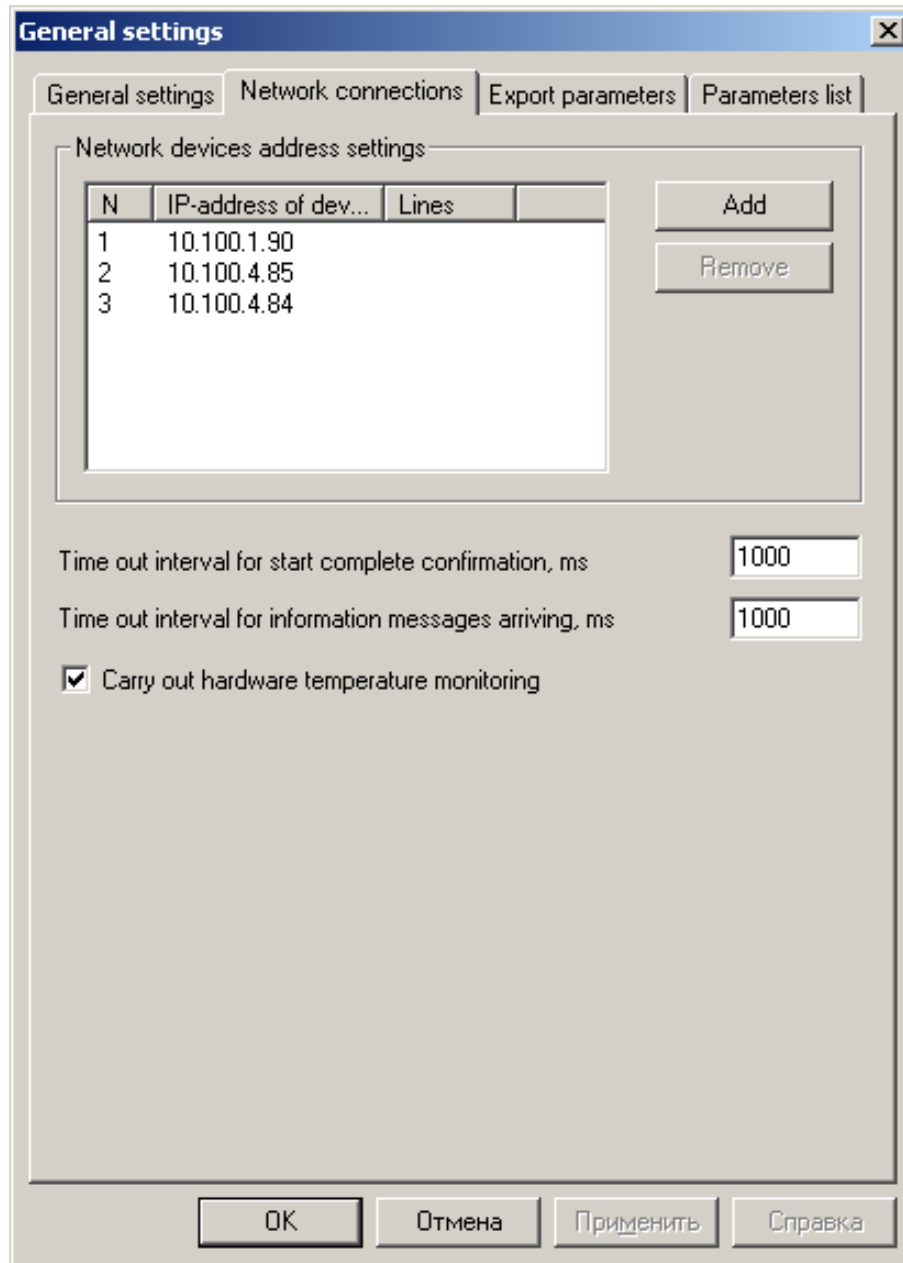


Fig. 5.8. **General settings** dialog box. **Network connections** page

In the **Network connections** dialog page the parameters of the Enhanced Ethernet Box system hardware are presented. Ethernet Box system differs from the others system types by availability of the Ethernet network connection between AE data aquisition block and visualization computer (usually notebook). Enhanced Ethernet Box system differs from the original Ethernet Box system by availability of individual IP-address box settings to supply connection of several AE data aquisition blocks to one visualization computer to increase total channel number.

- ◇ To activate individual IP-address of the definite AE data acquisition block add corresponding IP-address string into **Network devices address settings** control list. To add new IP-address string into the list use **Add** button. To remove previously added and selected IP-address string from the list press **Remove** button. To edit previously added IP-address string make double-click of the left mouse button onto selected string of the list. The individual IP-address can be obtained from the system passport or serial number.
- ◇ To set time out interval for start complete confirmation in ms input corresponding value into **Time out interval for start complete confirmation, ms** entry field (default value 1000 ms).
- ◇ To set time out interval for information messages arriving in ms input corresponding value into **Time out interval for information messages arriving, ms** entry field (default value 1000 ms).
- ◇ To start Ethernet Box hardware inside temperature monitoring set **Carry out hardware temperature monitoring** switch. The temperature information string will output into report file and system log window.

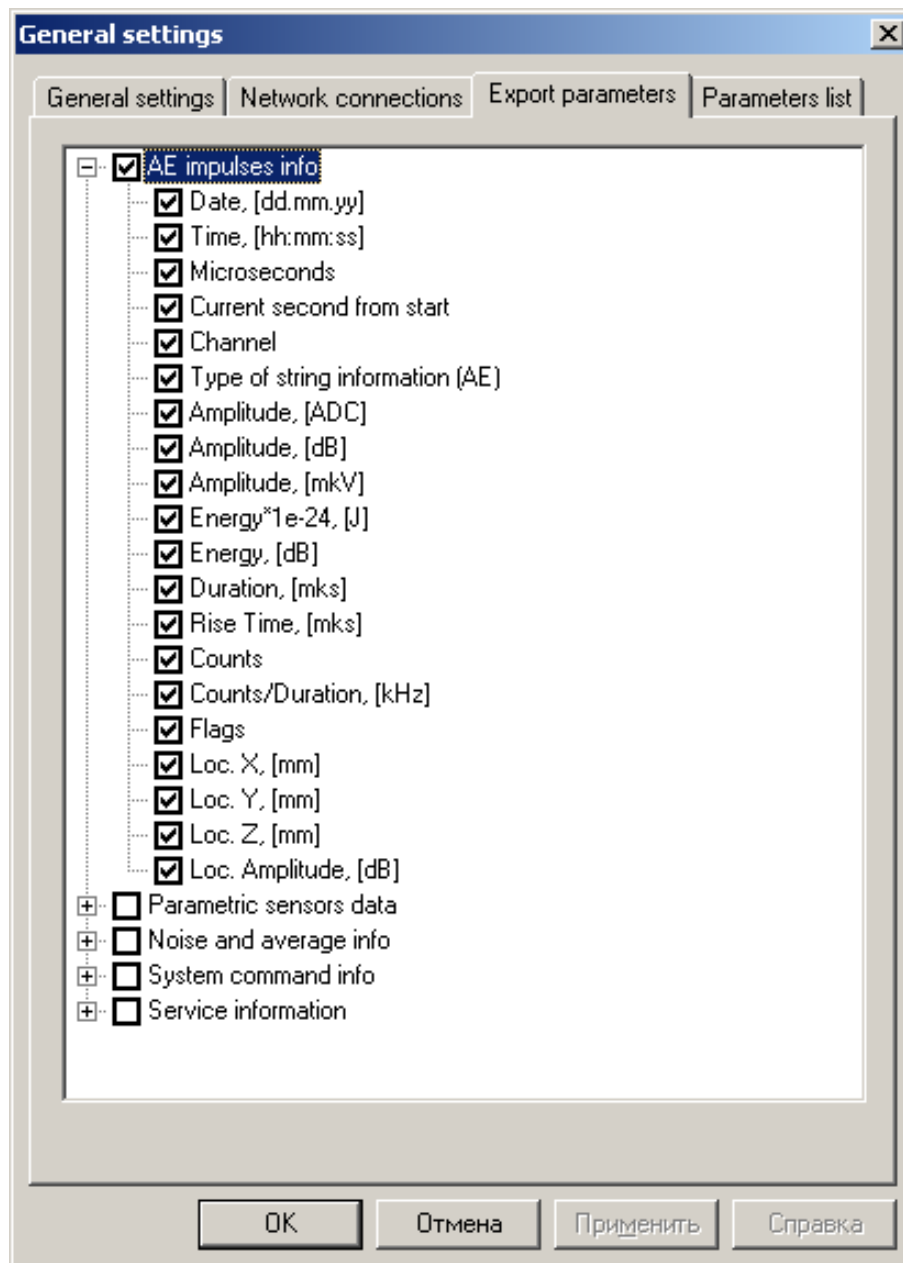


Fig. 5.9. **General settings** dialog box. **Export parameters** page

In the **Export parameters** dialog page the different information parameters previously saved into ALD file can be selected to be exported into plain text file for future use and processing. To select any parameter to be exported the corresponding switch within corresponding tree group should be activated. To cancel export of any parameter this switch should be deactivated.

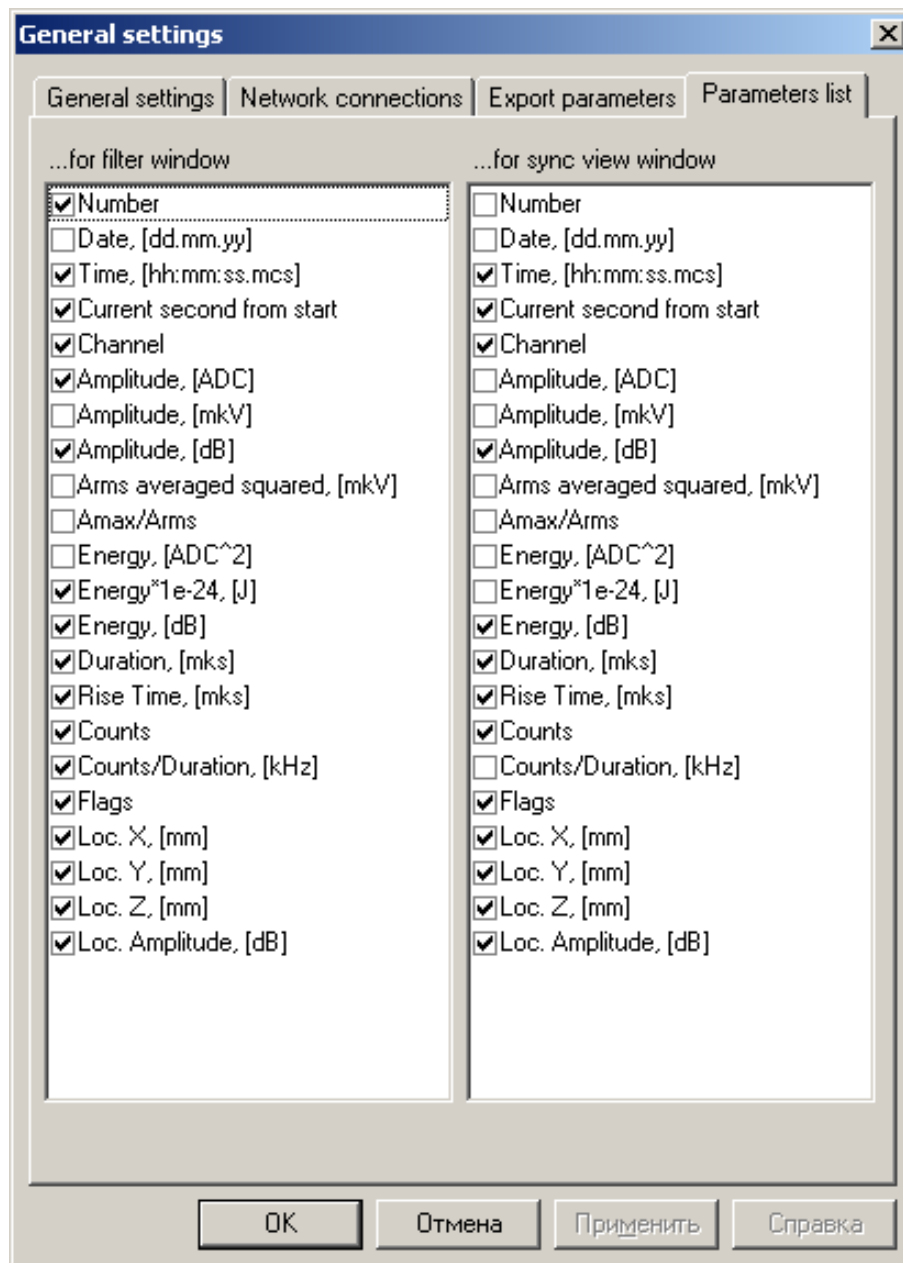


Fig. 5.10. **General settings** dialog box. **Parameters list** page

In the **Parameters list** dialog page the different AEP parameters can be selected to be presented into filter text window and sync view window. To select any parameter to be presented the corresponding switch within corresponding tree group should be activated. To cancel present status of any parameter this switch should be deactivated.

After setting the necessary parameters, press the **OK** button, for canceling, press the **Cancel** button. To apply changes without closing dialog box press **Apply** button.

5.10. Hotkeys setup

For setting the hotkeys system, use the **Options – HotKey settings** main menu option. After that the **HotKey settings** dialog box will appear.

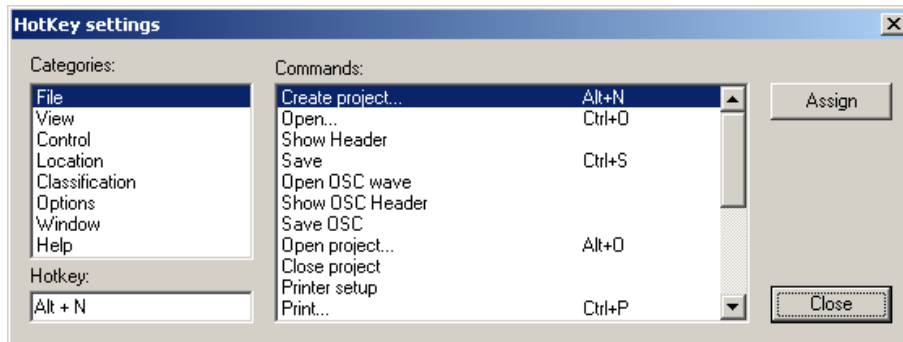


Fig. 5.11. HotKey Settings dialog box

Hotkeys settings will be specified in this dialog box.

- ◇ Select a main menu option in the **Categories** list. After that, a submenu of the selected option will appear in the **Commands** list.
- ◇ Select the necessary submenu in the **Commands** list.
- ◇ Enter description in the **Hotkey** entry field by using the **Ctrl**, **Alt** or **Shift** keys.
- ◇ Press the **Assign** button.

After that, the corresponding hotkeys combination will appear in the **Commands** list opposite to the option selected.

For canceling the set hotkeys combination or changing it, repeat the abovementioned procedure again. At that, enter the **No** option in the entry field or any other hotkeys combination.

After the end of the hotkeys setup, close the dialog box by using the Close button.



Chapter 6. Working with windows

* Chapter “*Working with windows*” describes operations with data representation windows.

6.1. Context menus

A context menu will be called by clicking the right mouse button in the corresponding section of the window:

- ◇ in the diagram display area;
- ◇ in the X or Y-axis area.

The context menu for the diagram display area is represented on the diagram:

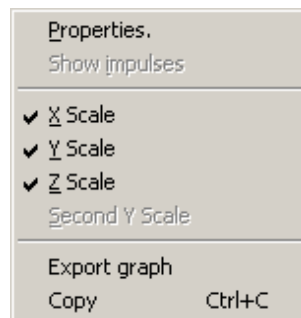


Fig. 6.1. Popup menu for display area

Option	Action
Properties	Adjusts the window parameters.
Show impulses	Show AEP parameters in the text or graphics format.
X Scale	Switches the X-axis on and off.
Y Scale	Switches the Y-axis on and off.
Z Scale	Switches the Z-axis on and off.
Second Y Scale	Switches the auxiliary Y-axis on and off.
Export	Converts the diagram contents into text format (for all real time, postprocessing and location windows).
Copy Ctrl+C	Copies the selected diagram to the Windows clipboard in graphical BMP format.

Context menus for X and Y-axes are identical for both axes.



Fig. 6.2. Popup menu for axes area

Option	Action
Properties	Adjusts the axis parameters.
Hide Scale	Switches the corresponding axis off.
Show other scale	Switches another axis on (in case the latter one is off).

6.2. Setting the window working field

For setting the working field of the windows select the **Options – Current Window** main menu option or right-click in the main field of the window with the mouse. Then select the **Properties** option in the context menu open. After that the **Graph Setup** dialog box will appear.

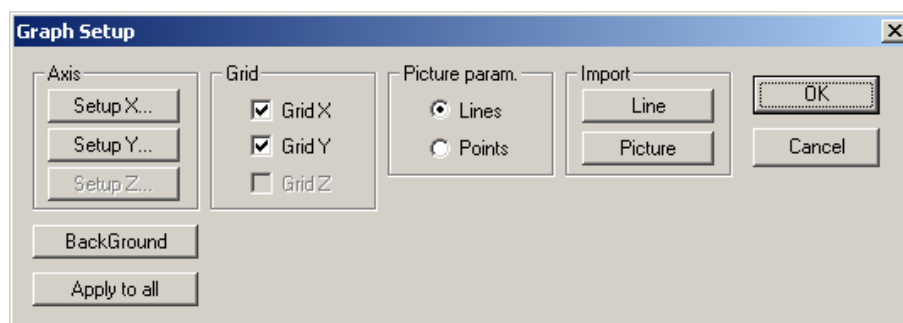


Fig. 6.3. **Graph Setup** dialog box

Window parameters will be set in this dialog box:

- ◇ For setting the X, Y or Z (for 3D windows only) coordinate axes press **Setup X**, **Setup Y** or **Setup Z** buttons in the **Scale** group correspondingly. Coordinate axes setup will be described below in “*Coordinate axes setup*”.
- ◇ For displaying the scale grid on X-axis, Y-axis or Z-axis (for 3D windows only), switch the **Grid X**, **Grid Y** or **Grid Z** switches correspondingly in the **Grid** group on.
- ◇ For changing the background color of the selected window press the **Background** button. The color selection will be performed with the help of the **Color** standard dialog box. The selected background color can be simultaneously set for all the windows by pressing the **Apply to all** button.
- ◇ For diagram representation with the help of lines set the **Lines** switch in the **Picture param** group. For diagram representation with the help of points set the **Points** switch in the same group. Note that for some windows only a single representation type is available.
- ◇ For changing the additional line parameters press the **Line** button in the **Import** group. Additional line setup will be described in “*Additional line setup*” on page 74.
- ◇ For changing the imported graphics parameters press the **Picture** button in the **Import** group. Imported graphics setup will be described in “*Imported graphics setup*” on page 76.

Location windows feature

Additional options will appear for location windows in the **Graph Setup** dialog box.

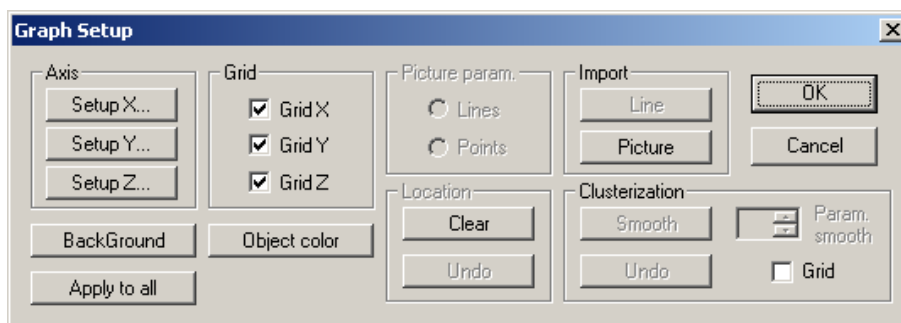


Fig. 6.4. **Graph Setup** dialog box for location window

- ◇ For clearing the location window from the location results press the **Clear** button in the **Location** group, press the **Undo** button to restore the location results.
Note that location clearing can be performed as during the data collection so during the postprocessing.
- ◇ In order to perform the cluster smoothing in the **Location/Coordinate, mm** and the **Location ampl, [dB] / Size, [mm]** windows at linear and plane location types, set the number of clusters by which you need to perform the smoothing using the **Param.smooth** spinner and press the **Smooth** button. Use the **Undo** button in the **Clusterization** group for returning to the location picture.
The smoothing procedure allows separating the location events, scattered chaotically in the location field and unite the areas with big number of events. For this, the color palette of the clusterization events number is used. Note, that the smoothing procedure is not available during the data collection.
- ◇ For switching on the clusterization grid in the plane type location windows, switch the **Grid** switch in the **Clusterization** group on. After changing the necessary parameters, press the **OK** button. For canceling the applied changes, press the **Cancel** button.
- ◇ Use **Object color** button to change color for the 3D location model in the corresponding windows. The color selection will be performed with the help of the **Color** standard dialog box.

6.3. Coordinate axes setup

For setting the X and Y coordinate axes it is necessary to press the **Setup X** or the **Setup Y** button in the **Graph Setup** dialog box correspondingly, or click the right mouse button in the axes field. Select the **Properties** option in the context menu open. After that the **Axis Setup Dialog** dialog box will appear.

Fig. 6.5. **Axis Setup Dialog** dialog box

Axes coordinates settings will be specified in this dialog box:

◇ In the **Type** group:

- For selecting the linear type scale on the Y-axis use the **Linear** switch.
- For selecting the logarithmic type scale on the Y-axis activate the **Log** switch.

Note that this group is not available for those windows, where the results have already been presented on the logarithmic scale.

◇ In the **General Setup** group:

- Set the initial and the final parameter values for the selected axis in the **Min** and **Max**, entry fields correspondingly. Use the **Auto** switch for automatic range selection.
- Set the number of points on the scale for the range examined in the **Marks** entry field.
- For convenient viewing and moving the viewing area on the time scale, use the scrolling function, by activating the **Scroll axis** switch.

This switch will be available for time scale only (X-scale). Description of the synchronous view results in all the windows with time dependency is given on page 71.

- Set the temporal window viewing value in seconds in the **s** entry field.
- The **Apply to all** button is available for all time scales. Pressing this button will allow to specify the set values of the temporal range and use the scrolling in all the windows where the dependencies between the parameters and time are presented.

◇ In the **View Setup** group:

- For changing the scale background color, press the **Background** button. Select the color by using the **Color** standard dialog box.
- For changing the parameter values color, press the **Text color** button. Select the color by using the **Color** standard dialog box.

- Selected scale background color and the parameter values color can be set simultaneously in all the windows by pressing the **Apply to all** button.
 - For displaying the coordinate axis, switch the **Show axis** switch on. Reset this switch for removing the coordinate axis.
- ◇ In the **Units** group, you can change the parameter values display method for some axis types.
- For temporal axes, select the time unit used for displaying by using the **sec**, **min**, **hour** switches.
 - Select the amplitude measurement unit for the Y-axis in the OSC window by using the **ADC**, **mcV** switches.
 - The OSC window makes possible display of the signal threshold level values, set on every channel for the Y-axis. For this, activate the **Show threshold** switch. In order to remove the threshold values diagram this switch should be reset.
 - The program makes available the normalization procedure for histogram postprocessing. For this, activate the **Axis Setup Dialog** dialog box (for the Y-axis) and set the **Normalization** switch in it. The normalization results can be used for conducting further comparative analysis of the distribution forms on every channel.

After setting the parameters, press the **OK** button. For canceling the changes made, press the **Cancel** button.

Scrolling

For convenient viewing and moving the windows with time dependencies and the viewing area on the time scale the program incorporates the scrolling function. For switching it on, activate the **Scroll axis** switch and set the temporal window viewing interval value in seconds in the **Axis Setup Dialog** dialog box.

After that, a scroll bar will appear in the lower part of the window with the selected viewing area width. The use of the scroll bar makes it convenient to move the viewing area within the whole range. At that, its width will remain unchanged, but the viewing area will change every time.

For simultaneous data viewing in all the temporal windows the program incorporates the synchronous scrolling function, described below.

Synchronous scrolling

For simultaneous viewing and moving the viewing area on the time scale in all the temporal window the program incorporates the synchronous scrolling mode for real time mode windows and postprocessing windows.

For activating this mode, use the **View-Sync Scroll** main menu option. Then call the **Axis Setup Dialog** dialog box for the time scale, use the **Scroll axis** switch there and specify the temporal window viewing interval in the **s** field. After that, a scroll bar will appear in the lower part of the window with temporal dependence, which makes it more convenient to move a part of the viewing area and change the viewing area.

In order to apply scrolling to all the windows with temporal dependency, use the **Apply to all** button in the **General setup** group and press the **OK** button. In case you need to apply scrolling not to all the windows with temporal dependency, activate it only in those windows, every time using a corresponding **Axis Setup Dialog** dialog box. Then use the scroll bar in one of the windows for time dependencies parameters. Viewing by time will

be observed in all the selected windows. In case there is no necessity for simultaneous viewing of processes in temporal windows, use the **View-Sync Scroll** main menu option again. After that, the area scrolling function will be executed for every temporal window separately.

6.4. Windows manager

Except the standard windows presented in “*Results display windows*” on page 9, the program allows creating the following additional windows:

- ◇ **Max. amplitude, [dB] / Time, [s];**
- ◇ **Max. counts / Max. amplitude, [dB];**
- ◇ unlimited number of windows, displaying the dependency of any parameter from any other parameter;
- ◇ unlimited number of windows, displaying the events number distribution after any parameter.
- ◇ up to 50 pairs of windows, displaying AEP waveforms and spectra.

To manage windows, select the **Window – Windows Manager** main menu option. After that the **Windows manager** dialog box will appear.

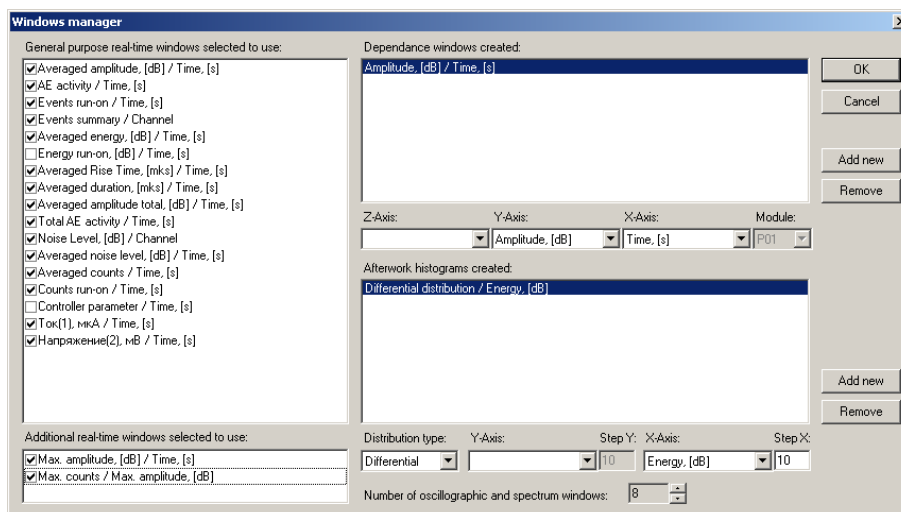


Fig. 6.6. **Windows manager** dialog box

Parameters of additional windows will be set in this dialog box:

- ◇ In order to create the any window from the general set described in “*Results display windows*” on page 9 the corresponding **Show** switch should be turn on from the **General purpose real-time windows selected to use** group.
- ◇ In order to create the **Max. amplitude, [dB] / Time, [s]** and the **Max. counts / Max. amplitude, [dB]** windows turn the corresponding **Show** switches in the **Additional real-time windows selected to use** group on. Maximal amplitude and count number will be performed after every averaging interval.
- ◇ In order to create new "any from any" dependence window, push button **Add new** in the **Dependence windows created** group. Then, select definite parameters in the **Z-Axis**, **Y-Axis** and **X-Axis** drop lists made available. It is possible to form 2D or 3D dependence windows. Previously formed windows are displayed into **Dependence**

windows created list. To remove and close any selected dependence windows press button **Remove** in this group.

- ◇ In order to create the distribution windows, push button **Add new** in the **Afterwork histograms created** group. Then, select definite parameters in the **Distribution type**, **Y-Axis** and **X-Axis** drop lists made available and specify the partitioning interval value in the **Step Y** and **Step X** spin group. It is possible to form 2D or 3D windows for differential or cumulative distribution. Previously formed windows are displayed into **Afterwork histograms created** list. To remove and close any selected distribution windows press button **Remove** in this group.
- ◇ To specify definite number of AEP waveform and spectrum windows pairs use **Number of oscillographic and spectrum windows** spin control.

After setting the parameters of the new window's set press the **OK** button, after which the new window's set will be applied. To cancel made changes press the **Cancel** button.

In case the additional windows have already been created, when opening the **Windows manager** dialog box, the features of the existing windows will be specified in the corresponding groups.

6.5. Page manager

The program provides for possibility of arranging the OWIW windows on several pages and performing operations (deletion, adding, renaming) with them. At that, the number of pages is not limited. For calling the dialog for controlling the program windows display pages, it is necessary to select the **Window-Page Manager** main menu option, after which the **Page Manager** dialog box will appear.

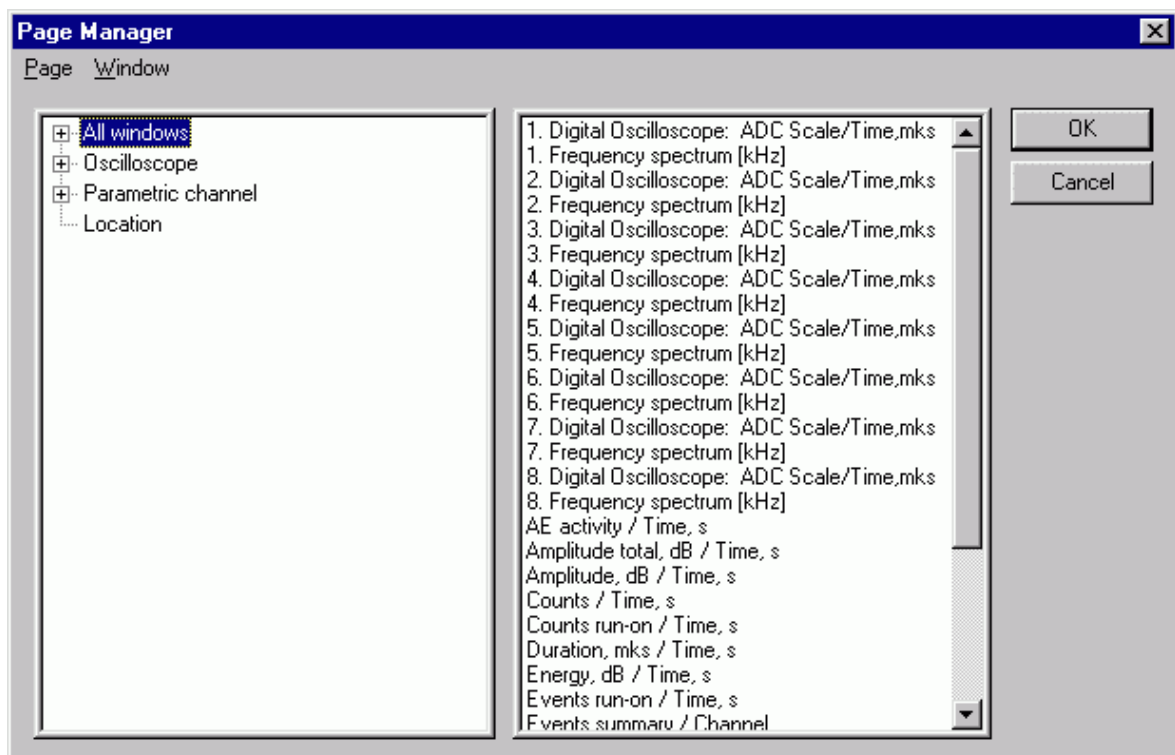


Fig. 6.7. **Page Manager** dialog box

When working with pages this window provides for following possibilities:

- ◇ new page creation – use the **Page-Add** main menu option, then enter the new page name and press the **OK**;
- ◇ page deletion – select the page name in the pages list (by using the mouse or the **Shift** key), then use the **Page-Delete** main menu option;
- ◇ renaming a page - select the page name in the pages list (by using the mouse or the **Shift** key), then use the **Page-Rename** main menu option and enter the new page name;
- ◇ deleting all the windows from the selected page - select the page name in the pages list (by using the mouse and the **Shift** key), then use the **Page-Clear** main menu option;
- ◇ adding all the windows from the left-hand list to the selected page - select the page name in the pages list (by using the mouse or the **Shift** key), then use the **Page-Fill** main menu option;
- ◇ adding one or several windows to the page selected - select the page name in the pages list (by using the mouse or the **Shift** key), select the window (windows) in the right-hand list of the window; then use the **Window-Add** main menu option;

Adding a window to the selected page can also be performed by using the mouse. For this move the mouse pointer and double-click with the left button on the name of the necessary window in the right-hand field of the dialog box. Note that the program does not allow adding the identical windows to one page.

- ◇ deleting a window from the selected page - select the page name in the pages list (by using the mouse or the **Shift** key), select the window (windows) in the left-hand list of the window; then use the **Window-Delete** main menu option;

Deleting a window from the selected page can also be performed by using the mouse. For this move the mouse pointer and double-click with the left button on the name of the necessary window in the left-hand field of the dialog box.

After creating the necessary pages filled with the corresponding windows, use the **OK** button, otherwise, use the **Cancel** button.

6.6. Imposing additional lines and diagrams

Additional line setup

For setting an additional line, press the **Line** button in the **Import** group of the **Graph Setup** dialog box. After that the **Import line from a file or parameter** dialog box will appear.

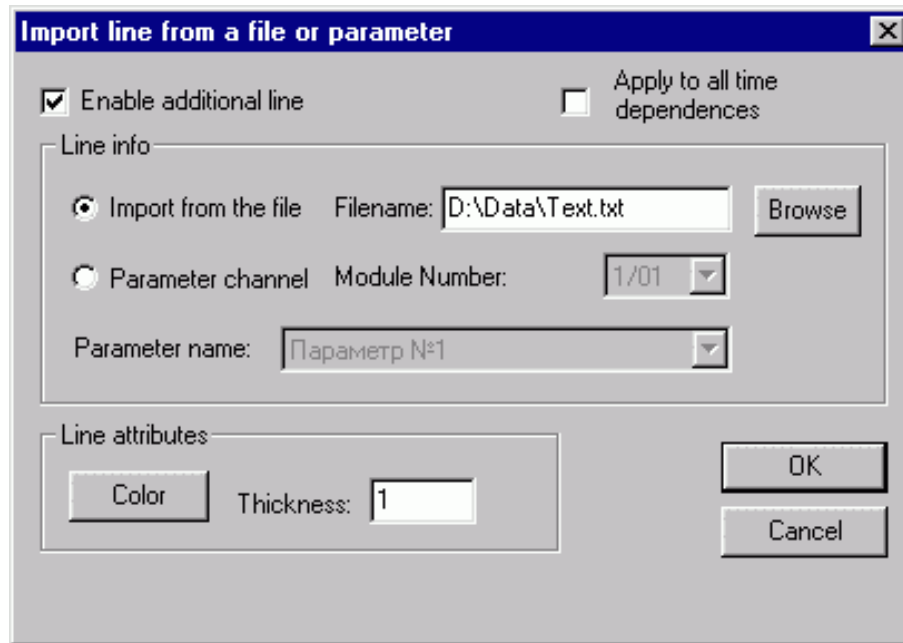


Fig. 6.8. **Import line from a file or parameter** dialog box

Additional line settings will be specified in this dialog box:

- ◇ For imposing an additional line activate the **Enable additional line** switch.
- ◇ Select the data source for an additional line in the Line info group.
 - For using the data from a file, switch the **Import from the file** switch on. Then, specify the file name in the **File name** entry field or press the **Browse** button and select the necessary file with the help of the **Open file** standard dialog box.
When imposing a line from the file you can specify its name by entering into a loading file a line, beginning with "!" symbol, after which the parameter name follows.
 - For using the data from a parametric channels switch the **Parameter channel** switch on and select channel number from the corresponding list. The name of this parametric channel will be used as a name of this parameter.
Note, that when imposing a line from a parametric channel on any window of time dependence, the name of this parameter will be displayed in the header of this window in the following way: "**Name of the Y-axis**"/ "**Name of the Y2-axis**"/"**Name of the X-axis**".
- ◇ Set the line display parameters in the **Line attributes** group.
 - For changing the line color press the **Color** button. After that, select the necessary color by using the **Color** standard dialog box.
 - Specify the line thickness in the **Thickness** entry field.
- ◇ In case when creating an additional line in the window with time selected on the X-axis, you switch the **Apply to all time dependences** switch on, the additional line settings will be applied to all the temporal dependency windows.

After setting the necessary parameters, press the **OK** button. For canceling the changes made, press the **Cancel** button.

Imported graphics setup

For setting the imported graphics, press the **Picture** button in the **Import** group of the **Graph Setup** dialog box. After that the **Import picture setting** dialog box will appear.

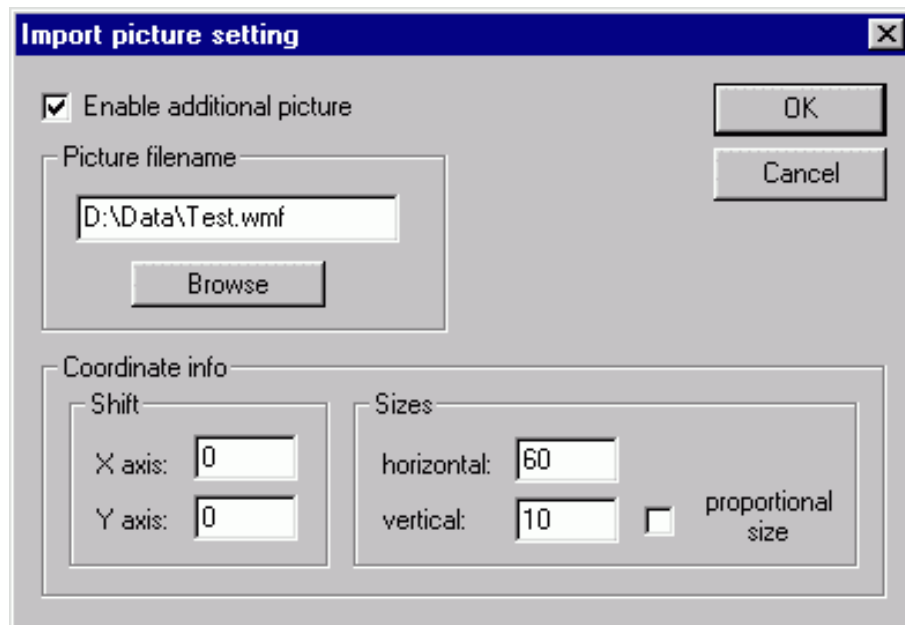


Fig. 6.9. **Import picture setting** dialog box

Imported graphics settings will be specified in this dialog box:

- ◇ For imposing the imported graphics activate the **Enable additional picture** switch.
- ◇ Specify the file name in the entry field of the **Picture file name** or press the **Browse** button and select the necessary file with the help of the **Open file** standard dialog box.
- ◇ Set the imported graphics display parameters in the **Coordinate info** group.
 - Enter coordinates of the point to where you need to place the graphic picture in the **X axis** and the **Y axis** entry fields of the **Shift** group.
 - Specify the image size in the **Horizontal** and the **Vertical** entry fields of the **Sizes** group.
 - For automatic size selection throughout the vertical line at fixed size proportionally to the dimensions of the original graphics file, switch the **proportional size** switch on.

After setting the necessary parameters, press the **OK** button. For canceling the changes made, press the **Cancel** button.

Creating a loading line

In order to create and impose a loading line on all the windows of temporal dependence (excluding parametric), select the **Window-Additional lines** main menu option. After that the **Additional lines** dialog box will appear.

When creating an additional line this window provides for following possibilities:

- ◇ Assigning a table of any size for data input.
 - Set the number of lines for data input with the help of the **Number of rows** spinner.
 - For inserting an additional line before a selected line use the **Insert** button.

- For deleting the selected data (the whole line / all lines will be deleted) use the **Delete** button.
- For adding a line at the end of the grid, use the **Add** button.
- ◇ Input of the additional line values.
 - Enter the values of the loading line on the X-axis and the Y-axis, as well as the necessary comments.
For entering the data, move the mouse pointer to the corresponding cell, activate it and enter the parameter value in the **Text for selected cell** entry field.
 - For deleting the data from the selected cell (cells), use the **Clear** button.
 - For deleting all the data from the grid and corresponding diagrams, use the **Clear all** button.
- ◇ Setting the additional line parameters.
 - Enter the parameter name (pressure, temperature etc.) in the **Name of parameter** entry field.
 - Set the imposition thickness with the help of the **Thickness** spinner in the **Parameters of line** group.
 - Select the line color with the help of the **Color** standard dialog box, pressing the **Color** button prior to it.
 - For sorting events by time activate the **Sort by X** switch.
- ◇ For calling an additional line from the text file, use the **Open** button. Then select the necessary file in the **Open file** standard dialog box.
- ◇ For saving the input data press the **Save** button. Then in the **Save as** standard dialog box specify the file name (with the .txt or .nag extension), where the loading line parameters will be saved.

After setting the parameters press the **Apply** button. The loading line will be displayed on all the time-dependent diagrams. When pressing the **Close** button, all the data entered will remain in the dialog box.

Recommendations on creating the joints map

In order to create a joints map and impose it on the location window perform the following:

- ◇ open the location file, select the necessary location window and "stretch" it to fit the screen size;
- ◇ copy the screen image to the clipboard (**Print Screen** button);
- ◇ run some vector graphics editor (e.g., *CorelDraw* or *Visio*);
- ◇ create a new image in the graphics editor;
- ◇ paste the image of the location window (**Edit-Paste** option);
- ◇ draw a rectangle around the border (without the axis field) and the joints map on the location object;
- ◇ delete the image of the location window (activate the image of the location window and press the **Del.** button), after which a rectangle with a joints map drawn should remain;
- ◇ export this image into the **Windows metafile** format (files with the .wmf extension) or **Enhanced Metafile** (files with the .emf extension);

- ◇ return to the Aline32D program to the location window and impose the file with the joints map image, obtained in the graphics editor (**Options-Current window** option).



Chapter 7. Location

* Chapter “*Location*” is all about location.

7.1. Intro

The program incorporates a special location function for determining the whereabouts of the AEP sources. Depending on the whereabouts the following location types may be applied:

- ◇ linear location;
- ◇ plane location;
- ◇ vessels location (cylindrical vessels);
- ◇ sphere location (spherical vessels);
- ◇ cone location (conic vessels);
- ◇ bottom plate location (for reservoirs);
- ◇ volume location (3D);
- ◇ zone location.
- ◇ constant picture (to visualize the result of another location group).

Note that the different location types may be applied simultaneously even for the similar sensors.

7.2. Determining the AEP propagation velocity and the distance between sensors

Determining the AEP propagation velocity.

For correct estimation of the defect’s whereabouts, it is necessary to know the velocity of AEP propagation into material. The program provides for automatic determination of this velocity. For this, it is necessary to select the **Location – New Velocity** main menu option. After that, the **Velocity/distance measurement scheme** dialog box will open.

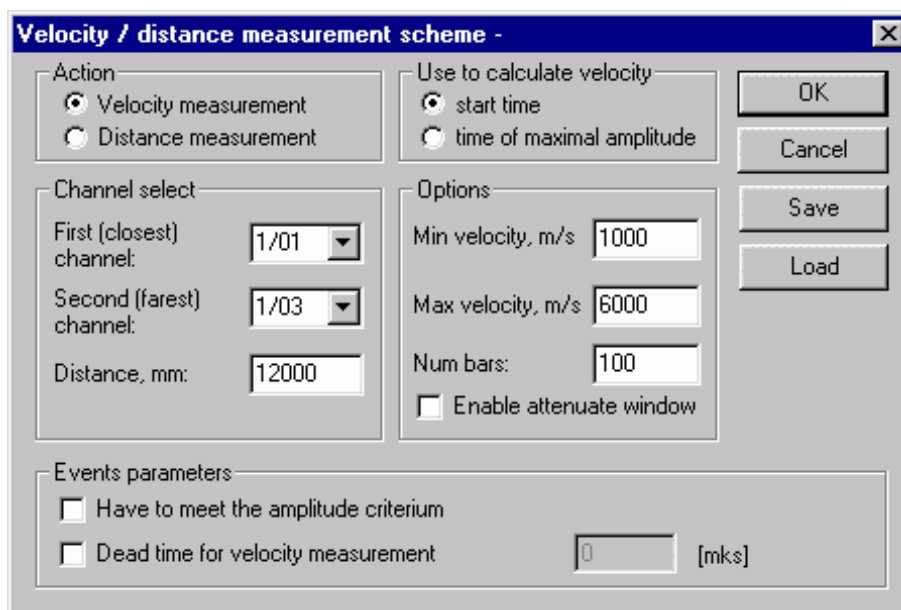


Fig. 7.1. **Velocity/distance measurement scheme** dialog box

In this dialog box, activate the **Velocity measurement** switch in the **Action** group. Then, specify the parameters, necessary for automatic determination of the AEP propagation velocity.

◇ In the **Channel select** group:

- select the numbers of the channels participating in velocity determination from the **First (closest) channel** (for the nearest sensor to the AEP imitator) and the **Second (most remote) channel** (for the remotest sensor) group;
- specify the distance between the sensors in the **Distance, [mm]** entry field.

◇ In the **Options** group:

- enter the range of the allowable velocities in the **Min velocity, m/s** and the **Max velocity, m/s** entry fields;
- specify the number of columns on the measured velocities histogram in the **Num bars** entry field;
- switch the **Enable attenuate window** switch on, for creating the window for determining the attenuation value.

◇ Select the calculation method In the **Use to calculate velocity** group:

- after the time of the first crossing of the threshold level by the AEP - activate the **Start time** switch.
- after the time of reaching the maximum AEP amplitude value - activate the **Time of maximal amplitude** switch.

The **Start time** switch is set in the program as default.

◇ When necessary, the additional criteria for automatic selection of the couples of events, selected for the velocity and attenuation calculation, will be set in the **Events parameters** group.

- *Amplitude criterion..*

For applying this criterion by which the amplitude of the AEP (in dB), arriving at the nearest sensor, should be not less than the amplitude of the signal at the remote

sensor, switch the **Have to meet the amplitude criterion with appropriate range** switch on. The difference between two AEP amplitude, obtained by two sensors, should be more than value, specified in the corresponding entry field.

- *Dead time criterion..*

For applying this criterion by which the difference of both signals arrival at both sensors should differ from the arrival times of the previously used couple not less then by the value of the dead time set, switch the **Dead time for velocity measurement** switch. Then enter the dead time value in the **[mcs]** entry field.

To create window for determining the AEP propagation velocity it is necessary to press the **OK** button, after which the **Velocity Measurement Histogram N / Velocity, [m/s]** window will be created. For canceling, select the **Cancel** button.



After creating the velocity measurement window it is necessary to perform an experiment with imitation of AEP.

Determining the distance between sensors.

In order to determine the distance between the sensors, it is necessary to repeat the procedure for calling the **Velocity/distance measurement scheme** dialog box. Then, in the dialog box open, activate the **Distance measurement** switch in the **Action** group and set the parameters for determining the distance between sensors. Note, that most parameters will be the same as for velocity determination.

- ◇ In the **Channel select** group:

- numbers of channels participating in velocity determination between the sensors, will be selected the same way as for AEP velocity determination;
- specify the AEP propagation velocity in the **Velocity, [m/s]** entry field.

- ◇ In the **Options** group:

- enter the range of the allowable distances in the **Min distance, [mm]** and the **Max distance, [mm]** entry fields;
- specify the number of columns on the distance distribution histogram in the **Num bars** entry field.

- ◇ The calculation method in the **Use to calculate velocity/distance** group will be the same as for velocity determination.

- ◇ In the **Events parameters** group the additional criteria will be selected in the same way as when determining the velocity.

In order to create a window for determination of the distance between the sensors press the **OK** button, after which the **Distance Measurement Histogram N / Distance, mm** window will be created. For canceling, select the **Cancel** button.



After creating the distance measurement window it is necessary to perform an experiment with imitation of AEP.

Operations with sensors arrangement scheme.

In case the parameters entered in the **Velocity/distance measurement scheme** dialog box will be necessary in the future, they can be saved by pressing the **Save** button.

Then, the **Save file** standard dialog box will appear, where it is necessary to specify a file name for saving the settings with the *cfg.* extension and press the **Save** button.

When necessary to perform a repeated velocity measurement using the previously saved sensors arrangement scheme, use the **Location – Open velocity** main menu option. Then, select the file containing the necessary sensors arrangement scheme in the **Open File** standard dialog box and press the **Open** button.

In order to correct the sensors arrangement scheme select the **Location – Edit current velocity** main menu option. Then, change the necessary parameter in the opened **Velocity/distance measurement scheme** dialog box.

You can close the velocity determination window by selecting the **Location – Close velocity** main menu option.

7.3. Forming location groups

For forming the location groups, select the **Location – New location** main menu option. Then, the **Location Scheme settings** dialog box will appear.

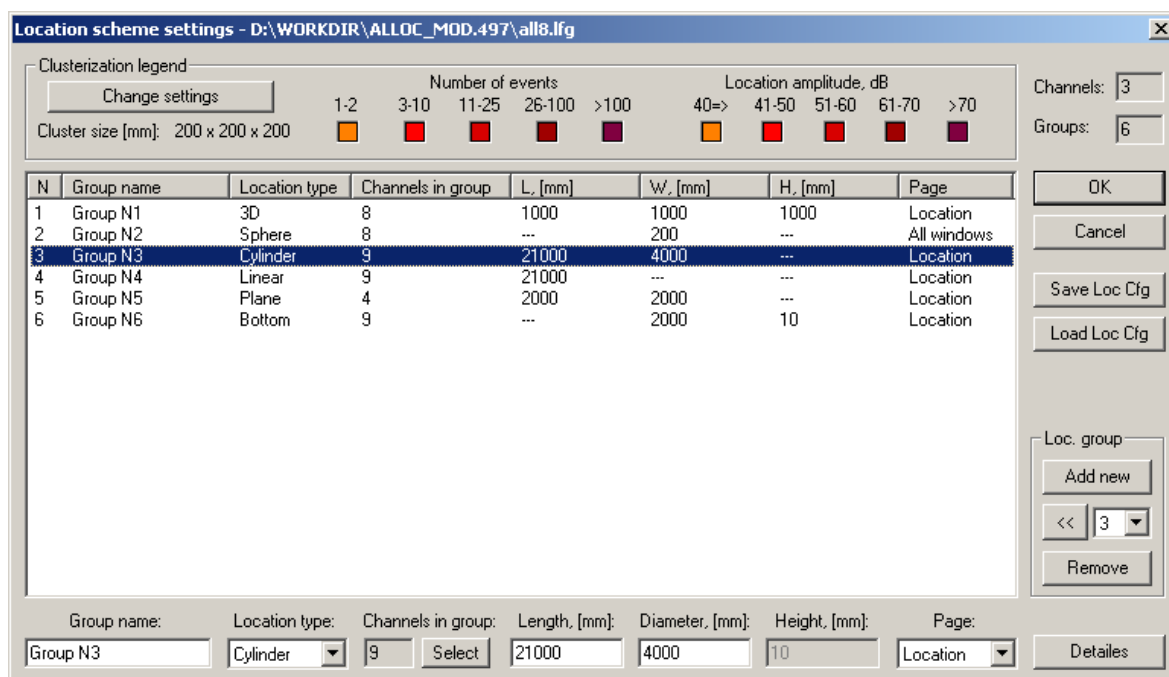


Fig. 7.2. **Location Scheme settings** dialog box

Location groups parameters should be set in this dialog box.

- ◇ To create the location group use button **Add New** in the **Loc. group** frame. To delete any of previously created location group select corresponding string in the group list control and push button **Remove** within the same frame. Also there is possibility to copy selected location group content to the newly created one. To do this operation select group number to copy from the drop list and push button **<<** within the same group frame.
- ◇ To change any location group settings select corresponding string in the group list control, then provide changes in the control string made available in the bottom part

of the dialog box. Enter the group name in the **Group Name** entry field. Select the location type in the **Location Type** drop list. The following location types are available:

- **Linear**;
 - **Plane**;
 - **Cylinder**;
 - **Sphere**;
 - **Bottom**;
 - **3D**;
 - **Zonary**.
 - **Picture**.
 - **Cone**.
- ◇ To select the numbers of sensors, included in this group, and the shape of the location antenna type – triangular or rectangular (for all plane location types) press **Select** near the **Channels in group** entry field. Selection of sensors, included in the location group, and shapes of the location zones will be described below, in the chapters dedicated to different location types. After the end of selection, control will return to the **Location Scheme Settings** dialog box, and the number of sensors included in the given group will be specified in the **Channels in group** field.
- ◇ Enter the size of the location area in the **Length, [mm]**, **Width, [mm]** or **Diameter, [mm]** and **Height, [mm]** entry fields. The geometrical features of different location types will be described in the chapters dedicated to corresponding location types.
- ◇ To select the window page to position current location group windows use drop list **Page**.
- ◇ Sensors arrangement scheme will be set by pressing the **Details** button. Then, depending on the location scheme selected, one of the location scheme parameters setup dialog boxes will open. Operations with these dialog boxes will be described in “*Sensors arrangement scheme setup*” on page 84 Chapter. The features of the scheme parameters setup at different location types will be described in the chapters dedicated to corresponding location types.
- ◇ The **Clusterization legend** group represents the color palette, used for displaying the number of located events and location amplitudes on the examined surface area, divided into conventional rectangles of the specified size. For changing the clusterization parameters press the **Change settings** button in this group. More detailed description of this operation will be given in “*Clusterization*” on page 106 Chapter.

Then press the **OK** button in the **Location Scheme Settings** window. After that the correspondence check of the cluster sizes and corresponding location groups size will be performed. For linear, plane and 3D volume location types, the correspondence of the lengths, widths and heights is direct. For vessel, sphere and bottom the correspondence check will be performed by scanning. In case the number of clusters per corresponding location group size will be less than five, inquiry for ignoring this situation will be made. When selecting the **No** button the **Clusterization settings** dialog box will appear, where it is necessary to change the cluster size. After that, the new location windows for every location group will be created. When selecting the **Yes** button, the new location windows

for every location group will be created at once, at any correspondence of the cluster size and location group size.



For canceling the changes made press the **Cancel** button in the **Location Scheme Settings** dialog box.

Additional features

After setting all the location groups parameters you can press the **Save Loc Cfg** button for saving the entered parameters. At that, the **Save as** standard dialog box will open, where it is necessary to specify the file name, where the location groups settings will be saved and press the **Save** button.

In case the location groups settings were saved before, they can be loaded by using the **Location – Open location** main menu option or pressing the **Load Loc Cfg** button. After that, select the necessary file in the **Open File** standard dialog box and press the **Open** button. Then the **Location Scheme settings** window will appear, which shows the settings, contained in the file. In case of selecting the wrong file press the **Cancel** button or press the **OK** button for accepting the scheme offered.

To change the current location groups set use the **Location – Edit current location** main menu option. After that you can set the necessary changes to the location groups parameters, add new or delete the existing location groups opened **Location Scheme settings** dialog box.

For clearing the location windows from the location results, you can use the **Location – Clear Locations** main menu option, or  button on the **Toolbar**. For restoring the location windows, use the **Location – Restore Locations** main menu option, or press the  button on the **Toolbar**. The procedure for clearing and restoring the location windows is also possible through the **Properties** context menu.

7.4. Sensors arrangement scheme setup

Sensors arrangement scheme setup consists in setting the sensors coordinates, used in location, parameters setting and forming the location zones.

- ◇ Sensors arrangement scheme setup will begin with setting the sensors coordinates in the corresponding dialog boxes for location schemes setup. Sensor coordinates can be set either relatively to zero or relatively to other sensors position. More detailed description of this operation is given below in “*Setting sensors coordinates*”.
- ◇ Set the additional parameters in the **Optional constants** group.
 - Enter the AE wave propagation velocity in the **Velocity [m/sec]** entry field.
 - Set the sensor image size on the diagrams in the **Image Diameter** entry field.
 - By linear location, specify the number of columns in the location histogram in the **Num Local Bars** entry field.
 - By plane location schemes, specify the value of the location zone around the sensors in the **Bound region** entry field. When exiting the dialog boxes of the location scheme parameters setup a check for the adequacy of the "cut-off zone" will be performed. The sources of AEP, located outside the boundaries of this zone will be eliminated.

- ◇ For all the plane location types (plane, cylinder, sphere, cone, bottom) the **Edit Zones** button is available in the **Location zones** group, allowing to distribute the sensors in zones. Note that the program makes possible automatic partitioning of the area into triangular and rectangular zones after the previously set sensors coordinates. At that, the zones will be formed from sensors with different numbers in such a way that they intersect with each other and are nondegenerate (i.e. the triangle or rectangle area differs from zero). More detailed description of this operation is given below in “*Sensors distribution in zones*” on page 87.
- ◇ For using the additional location options press the **Advanced** button. After that, the **Advanced location options** dialog box will open. Operations with this window will be described in “*Additional location options*” on page 102.
- ◇ In order to perform filtering after location press the **Filter** button. After that, the **Location filter dialog** dialog box will open, where it is necessary to set the filtering parameters. Operations with this window will be described in “*Filtering after location*” on page 104.

After setting the sensors arrangement scheme press the **OK** button, after that control will return to the **Location scheme settings** dialog box.

7.5. Setting sensors coordinates

It was noted in the previous Chapter that coordinates can be set relatively to reference points or relatively to other sensors. For different location types there are following reference points:

- ◇ For linear location - zero, left-hand end, right-hand end.
- ◇ For plane location and picture - zero, left-hand lower corner, left-hand upper corner, right-hand lower corner, right-hand upper corner.
- ◇ For vessels and cone location (cylindrical vessels) - zero.
- ◇ For sphere location (spherical vessels) - none.
- ◇ For bottom location - Bottom, 3 hours.
- ◇ For 3D volume location - none.
- ◇ For zone location – coordinates will not be set.

Start the sensors arrangement scheme with setting the sensors coordinates. Position of the reference points will be examined in the corresponding location chapters.

- ◇ For setting the sensors coordinates, perform the following operations in the **Manual setup** group (or in the **Three-Dimensional details setup dialog** group in case of 3D volume location):
 - Select the sensor number in the **Channels** drop list.
 - Select the reference point of the sensor’s position (relatively to zero or to another sensor) in the **Relatively** drop list.
 - Set the sensor’s shift relatively to the selected reference point in the **Shift along X[mm]**, **Shift along Y[mm]** and the **Shift along Z[mm]** entry fields.
 - Press the **Apply** button.

Note that the absolute value of the coordinates relatively to zero will be specified in the **Coordinate** group in the **X[mm]**, **Y[mm]** fields. Note also that both coordinates are not used for all location types (e.g., by linear location only one coordinate is used).

- ◇ Sensors coordinates setup can be performed with the help of the mouse.

Except entering the sensor coordinates directly from the keyboard, you can also set the sensors coordinates with the help of the mouse. For this, left-click with the mouse on the sensor image and by holding the button down, move the sensor to the necessary position. The abovementioned operation should be repeated for every sensor. At that, the channel number and the sensor coordinate will be displayed in the **Coordinates** group, as well as in the **Manual Setup** group.

Note that in case of the 3D volume location the option of setting the sensors coordinates with the help of the mouse is not available. At zone location sensors, coordinates are not set at all.

The program also provides for possibility of automation of the coordinates setting process.

- ◇ For forming the location scheme during the linear location (as well as during other location types) it is convenient to use the following method for setting the sensors coordinates:

- Activate the **Auto** switch in the **Manual setup** group.
- Select the **01** channel number in the **Channels** list.
- Select **Zero** in the **Relatively** list.
- Set the position of the **01** sensor in the **Shift along X[mm]** entry field (when necessary, also set the **Shift along Y[mm]** and the **Shift along Z[mm]**).
- Press the **Apply** button.
- Select the next channels (**02** and **01**, correspondingly) in the **Channels** and **Relatively** list.
- Set the position of the **02** sensor relatively to **01**.
- Press the **Apply** button.

The channel numbers in the **Channels** and the **Relatively** lists will increase automatically.

Set the coordinates of the remained sensors in the same way.

- ◇ Set the coordinates of the remained sensors in the same way:
 - Select the necessary channel numbers in the **Channels** and the **Relatively** lists.
 - After that the necessary value will appear in the **Shift along X[mm]** (or **Shift along Y[mm]** and **Shift along Z[mm]**) field.
- ◇ For moving the zero, press the **Shift** button in the **Coordinates** group. After that the **Coordinate origin shift** dialog box will appear.

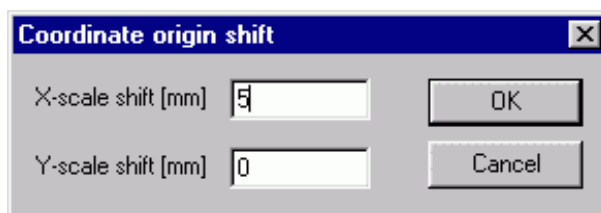


Fig. 7.3. **Coordinate origin shift** dialog box

Zero shift is possible for all location types, except the bottom location, 3D volume and zone location.

Set the shift value in the **X-scale shift, mm** and the **Y-scale shift, mm** entry fields.

For setting the shift press the **OK** button. For canceling the changes applied, press the **Cancel** button.

7.6. Sensors distribution in zones

Press the **Edit Zones** button for distributing the sensors in location zones in dialog boxes for plane location schemes parameters setup. After that, it will be possible to change the sensors distribution in zones.

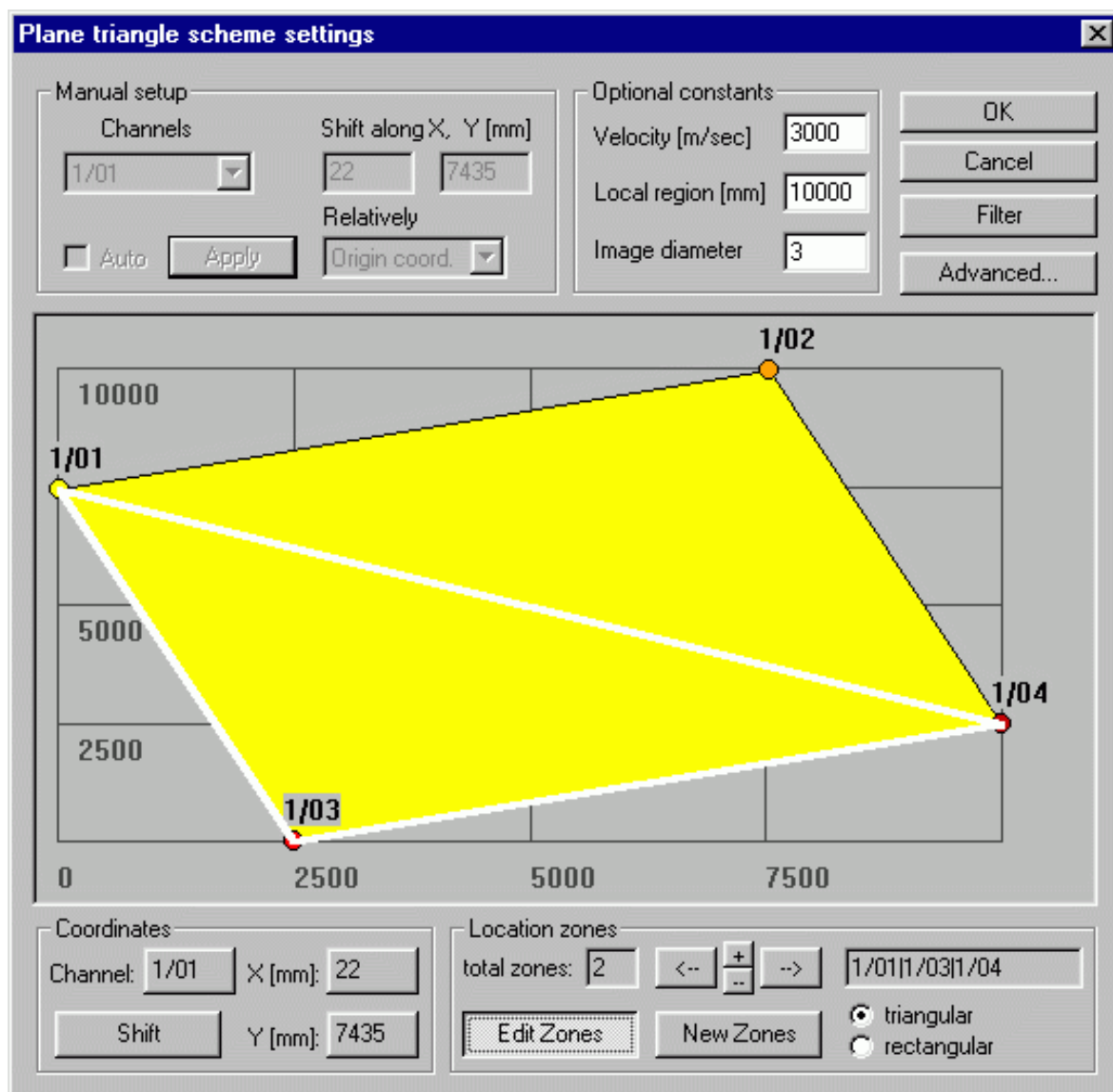


Fig. 7.4. **Plane Triangle Scheme Settings**
dialog box in location zones determination mode

- ◇ For selecting a zone, use the **<--** and the **-->** buttons in the **Location Zones** group. The zone selected will be highlighted with a white outline.
- ◇ For adding a zone, press the **Add** button in the **Location Zones** group. After pressing the **Add** button, the **Adding or Deleting Location Zones** dialog box will appear.

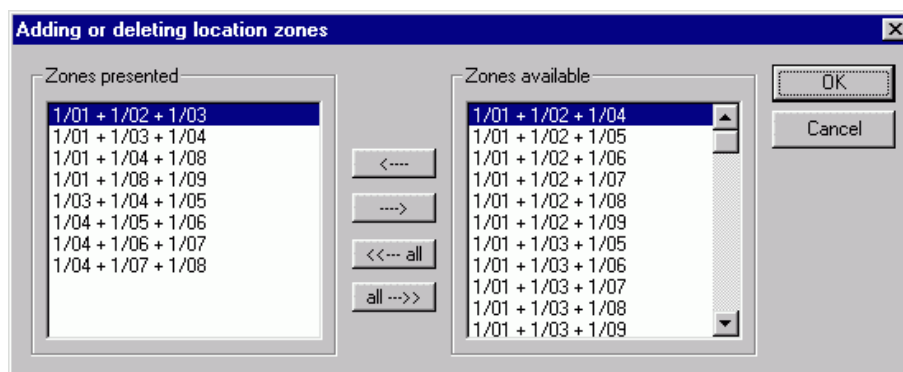
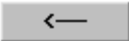
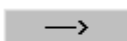


Fig. 7.5. **Adding or Deleting Location Zones** dialog box

In this dialog box, you can add or remove the location zones, formed by three or four sensors. The already existing zones are listed in the **Zones Presented** list, and the zones, which can be added, are listed in the **Zones Available** list. There are following options for moving a zone from one list to another:

- double-click with the mouse on the necessary zone in the corresponding list;
- select the necessary zone by a single mouse click and press the  or the  button.

After finishing forming the location zones in the **Adding or Deleting Location Zones** dialog box press the **OK** button. For canceling the changes applied, press the **Cancel** button.

- ◇ For deleting the selected zone press the **Delete** button in the **Location Zones** group.
- ◇ For changing the selected zone configuration click the mouse on the zone vertex, and while holding it, move the mouse pointer to the new zone vertex and only then release the mouse button.

After correct setting of all the zones press the **Apply** button in the **Location Zones** group. Then the plane location schemes parameters dialog boxes mode returns to the sensors coordinates setup mode.

7.7. Linear location

When using the linear location type the examined area is characterized by one dimension (length). This location type is used as a rule for examination of the lengthy objects (i.e. when one of the dimensions is much higher than the others), such as industrial pipe-lines, beams, elements constructional elements of hoisting cranes, bridges etc.

Including sensors into a location group

In order to include the sensors into a location group, press the **Select** button in the **Location Scheme Settings** dialog box. After that the **Including or Excluding sensors from group** dialog box will appear.

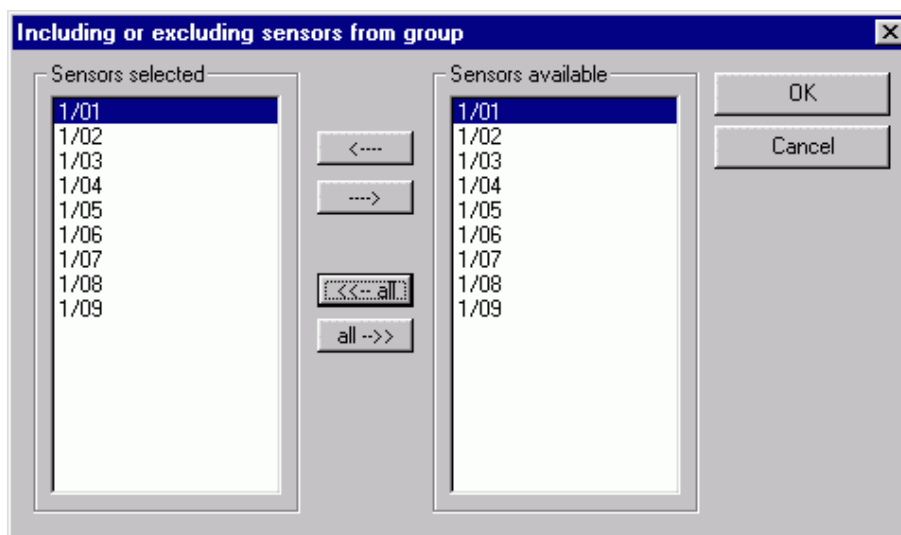

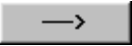

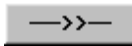


Fig. 7.6. Including or Excluding sensors from group dialog box

In this dialog box it is possible to increase and decrease the number of sensors, included into a location group.

- ◇ For including a sensor into a group, provisions are made for the following options:
 - double-click with the mouse on the number of the necessary sensor in the **Sensors available** list;
 - select the necessary channel number by a single mouse click and press the  button.
- ◇ For deleting a sensor from the group perform the similar operations in the **Sensors selected** list, by using the  button.
- ◇ In order to include or delete all the sensors from a group simultaneously, press the  or the  button.

After finishing the channels selection press the **OK** button, for canceling selection use the **Cancel** button. For sensors selection during other location types the **Select channels** dialog box, similar to the **Including or Excluding Sensors** from group dialog box is used.

Sensors arrangement scheme setup

For setting the sensors arrangement scheme press the **Details** button in the **Location Scheme Settings** dialog box. After that the **Linear Scheme Settings** dialog box will appear.

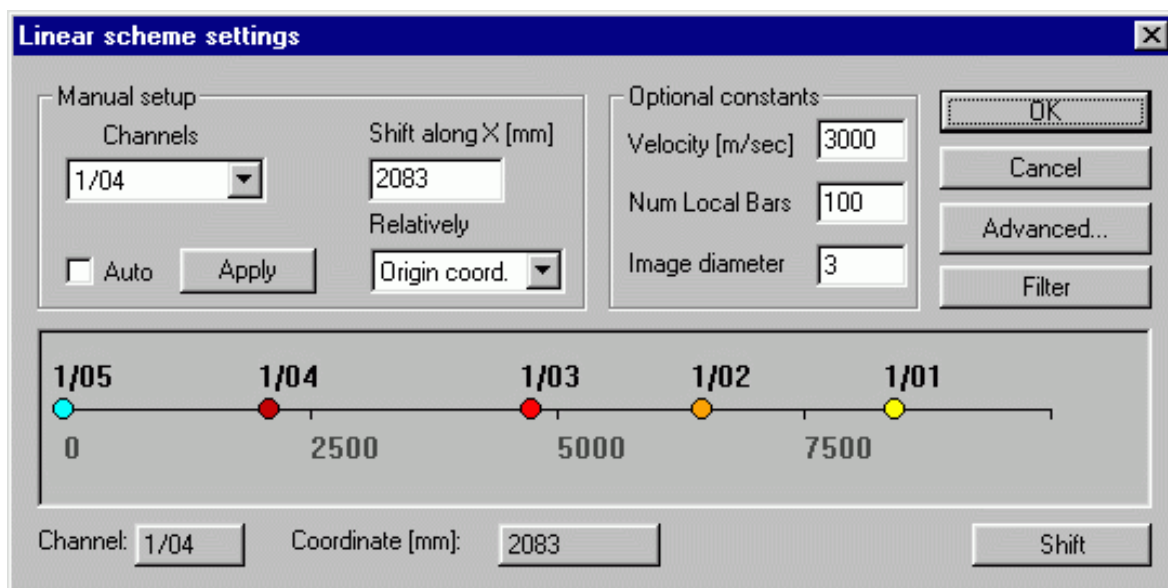


Fig. 7.7. **Linear Scheme Settings** dialog box

Operations with this dialog box are described in the Chapter “*Sensors arrangement scheme setup*” on page 84. Among the features of this location type, it is worth noting just one coordinate and the absence of location zones. The reference points for the linear location are the **Zero**, **Left-hand edge** and **Right-hand edge** points. If you do not use the coordinates shift, position of the **Zero** reference point coincides with position of the **Left-hand edge** point. Otherwise, there are three independent points.

7.8. Plane location

When using location of the plane type the examined area is characterized by two dimensions (length and width). This location type is applicable for control of the flat (sheet) constructions, certain areas of adjacent constructions.

Including sensors into location group

In order to include the sensors into a location group, press the **Select** button in the **Location Scheme Settings** dialog box. After that, as in the case of linear location, the **Including or Excluding sensors from group** dialog box will appear. Operations with this dialog box are described on on page 89. There is also a possibility for using the location zones of different shapes. For this, activate whether the **Triangular** switch – for triangular zones, or the **Rectangular** switch for quadrangular zones in the **Zone** type group.

Sensors arrangement scheme setup

For setting the sensors arrangement scheme, press the **Details** button in the **Location Scheme Settings** dialog box. After that, the **Plane Triangle Scheme Settings** will appear dialog box.

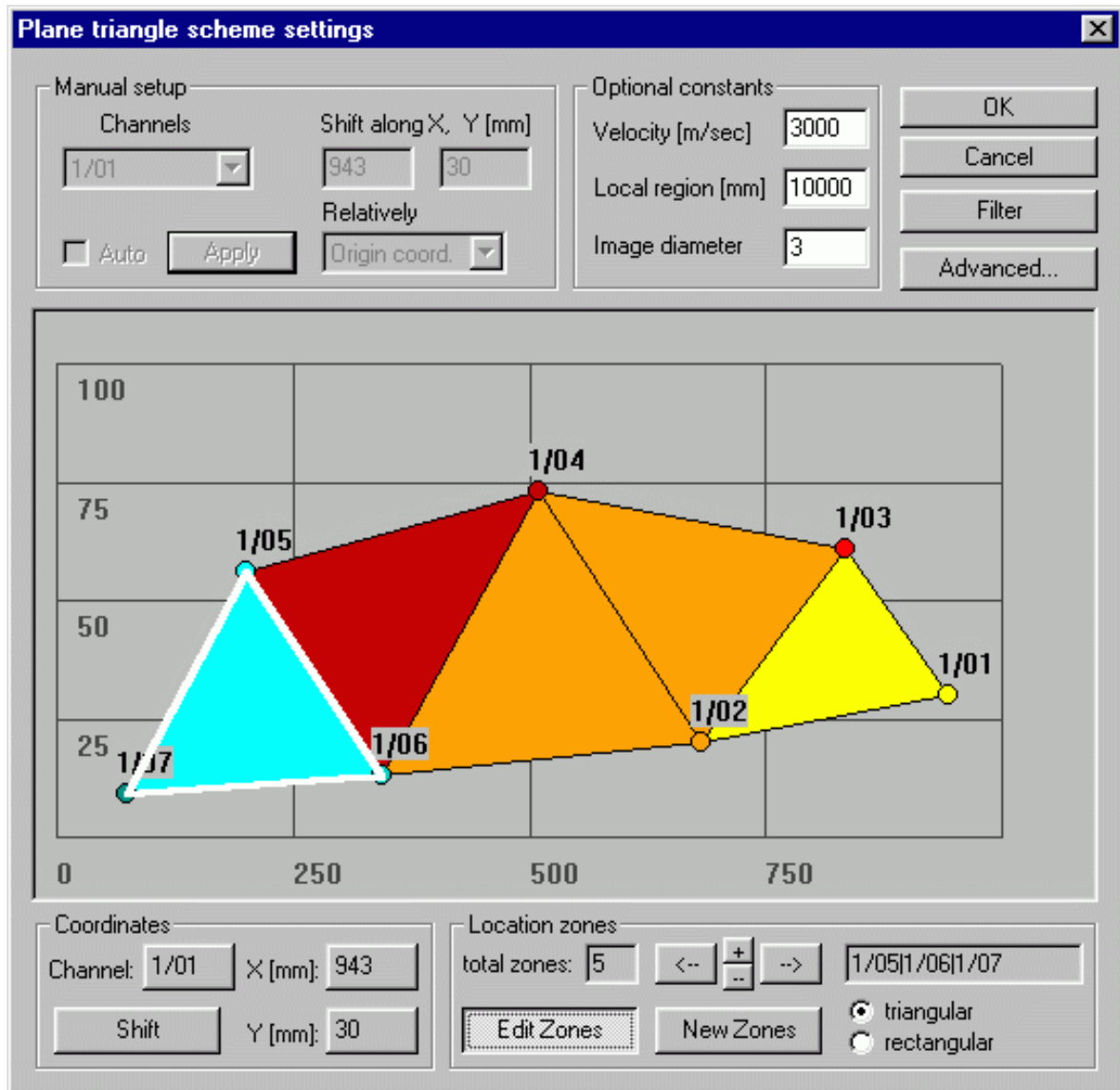


Fig. 7.8. Plane Triangle Scheme Settings dialog box

Operations with this dialog box are described in the Chapter “*Sensors arrangement scheme setup*” on page 84. For this location type the reference points are the **Zero**, **Left-hand Lower Corner**, **Left-hand Upper Corner**, **Right-hand Lower Corner**, **Right-hand Upper Corner**. By analogy with the linear location, position of the **Zero** point may change. In case of no shift, its position will correspond with the **Left-hand Lower Corner** point.

7.9. Cylinder location (cylinder vessels)

When using the cylinder location the examined area is characterized by two dimensions (length and bottom radius). This location type is applied for controlling cylinder vessels.

Including sensors into location group

In order to include the sensors into a location group, press the **Select** button in the **Location Scheme Settings** dialog box. After that the **Select channels for 3D scheme** dialog box will appear.

The dialog box is titled "Select channels for 3D scheme". It contains three main sections for sensor placement:

- Left round cover:** Includes a checkbox "Include in location" (checked), "Total channels used: 3", and a list of "Channels selected" (1/01, 1/02, 1/03). A "Change" button is below the list. "Centered channel" is set to "No" and "Height [mm]" is 1000.
- Medium cylinder:** Shows "Total channels used: 6" and a list of "Channels selected" (1/01, 1/02, 1/03, 1/04, 1/05, 1/06). A "Change" button is below the list. "Number of belts to use" is 3, and "Place sensors on board" is checked.
- Right round cover:** Includes a checkbox "Include in location" (checked), "Total channels used: 4", and a list of "Channels selected" (1/06, 1/07, 1/08, 1/09). A "Change" button is below the list. "Centered channel" is set to "1/C" and "Height [mm]" is 1000.

At the bottom, there are two groups of radio buttons: "Antenna type" (Triangular zone, Rectangular zone) and "Vessel position" (horizontal, vertical). "OK" and "Cancel" buttons are at the bottom right.

Fig. 7.9. **Select channels for 3D scheme** dialog box

Sensors distribution in vessel's section will be set in this dialog box:

- ◇ in the center of the dialog box – on the ring;
- ◇ in the right-hand and left-hand parts – on bottoms.
- ◇ For including the right and/or left bottom, set the **Include in location** switches in the corresponding part of the dialog box. After that, it will be possible to determine the parameters of this part.
- ◇ For selecting the sensors, participating in ring and bottoms location, press the **Change** button in the corresponding group. After that, the **Select channels** dialog box, similar to the Including or **Excluding Sensors** from group dialog box will appear, the operations with which are described on page 89 After closing the **Select channels** window, the number of the selected channels is specified in the **Total channels used** fields and these channels are listed in the **Channels selected** lists.
- ◇ In the **Medium cylinder** group, it is necessary to set the parameters of sensors arrangement on the ring.
 - The number of location belts (the number of sensor rows on the object) will be specified in the **Number of belts to use** entry field.
 - The method for sensors arrangement will be selected with the help of the **Place sensors on board** switch. In case the switch is set, the utmost location belts will

be placed on the border of the ring and bottoms. Otherwise, the location belts will be evenly arranged on the ring.

- ◇ Set the parameters of sensors arrangement on bottoms in the **Left round cover** and **Right round cover** groups.
 - Number of the sensor, located in the center of the bottom will be selected from the **Centered channel** list.
 - Bottom height (bottom embedding value) will be set in the Thickness [mm] entry field.
- ◇ In order to select the shape of the location zone, activate the corresponding switch in the **Zone type** group.
 - Zones of triangular shape will be selected with the help of the **Triangular** switch.
 - Zones of quadrangular shape will be selected with the help of the **Rectangular** switch.

After setting all the parameters, press the **OK** button. For canceling the changes applied, press the **Cancel** button.

Sensors arrangement scheme setup

For setting the sensors arrangement scheme, press the **Details** button in the **Location Scheme Settings** dialog box. After that the **3D-Volume details setup dialog** dialog box will appear.

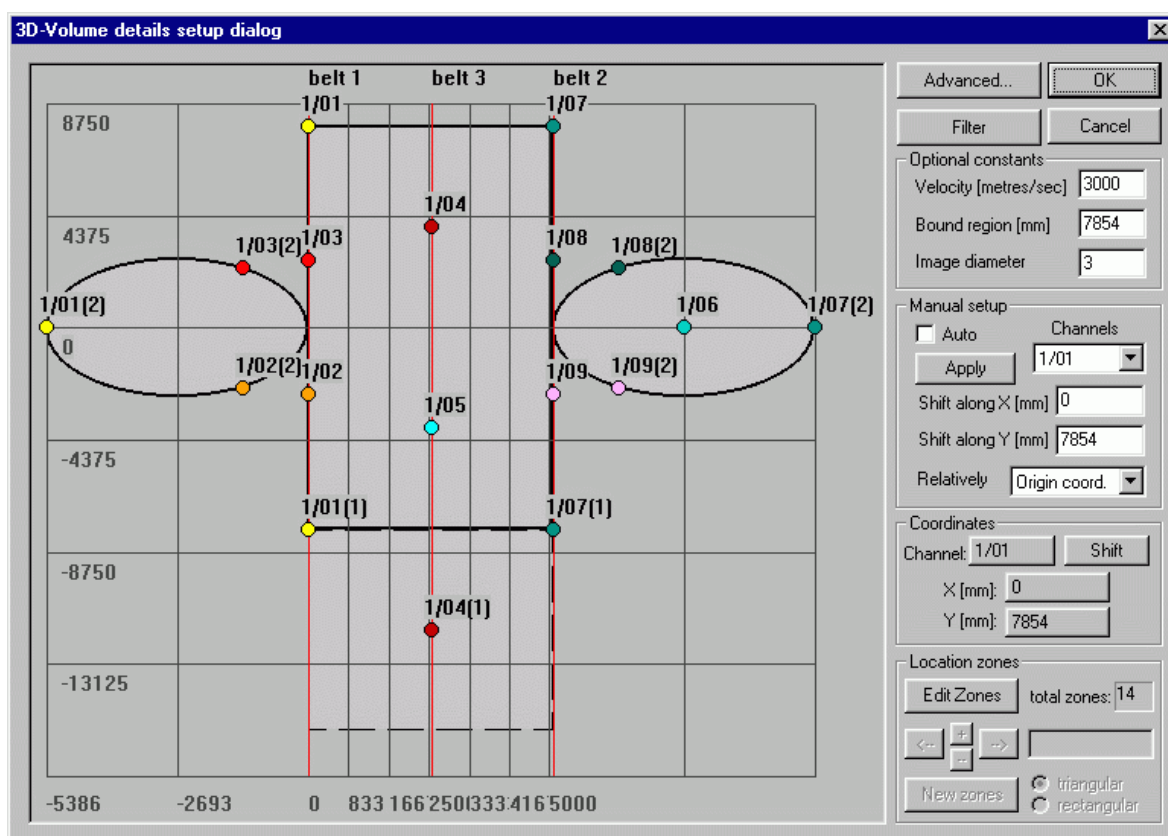


Fig. 7.10. **3D-Volume details setup dialog** dialog box

Operations with this dialog box are described in the Chapter “*Sensors arrangement scheme setup*” on page 84. For this location type the reference point is the **Zero**. In

case the coordinates shift is not applies, the **Zero** point is located in the point of contact of the **Bottom 1** and the left edge of the **Medium cylinder**, as shown on the diagram.

7.10. Sphere location (spherical vessels)

When using this location type the examined area will be set by one parameter (sphere radius). This location type is used for controlling the spherical vessels.

Including sensors into location group

In order to include the sensors into a location group, press the **Select** button in the **Location Scheme Settings** dialog box. After that the **Select channels for 3D sphere** dialog box will appear.

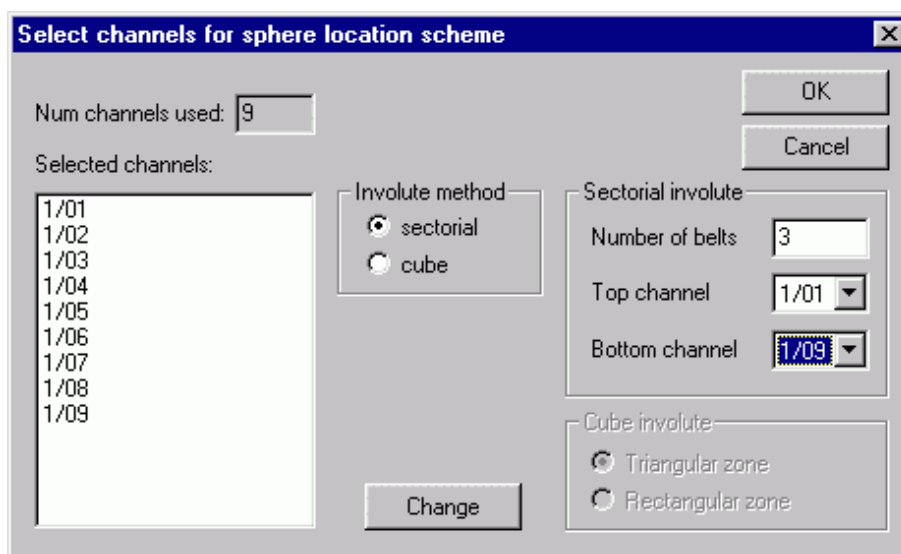


Fig. 7.11. **Select channels for 3D sphere** dialog box

This dialog box sets sensors distribution in a sphere's sections.

- ◇ For selecting the sensors, participating in location, press the **Change** button. After that, the **Select channels** dialog box, similar to the **Including or Excluding Sensors** from group dialog box will appear, the operations with which are described on page 89. After closing the **Select channels** window the number of the selected channels will be specified in the **Num channels used** field, and these channels will be listed in the **Selected Channels** list.
- ◇ After selecting the channels, it is necessary to specify the sphere location method. For this activate the corresponding switch in the **Involute method** group.
 - In case of sector sphere location, set the **Sectorial** switch.
 - In case of cubic sphere location, set the **Cube** switch.

Note that when selecting the cubic type of the sphere location, default arrangement of the sensors first will be performed on the corners of the cube inscribed into a sphere. Then – thru the centers of faces and edges. Such sensor arrangement assumes the use of at least eight sensors. Sensors coordinates and location results display result in the coordinate system "Length"(X) - "Width"(Y).

- ◇ In case of selecting the sector method of sphere location the **Sectorial involute** group becomes available. It is necessary to specify the additional parameters in it.

- The number of location belts (the number of sensor rows on the object) will be specified in the entry **Number channels' belts** field.
 - The number of a sensor located on top will be selected from the **Top channel**
 - The number of a sensor located below will be selected from the **Bottom channel** list.
- ◇ In case of selecting the cubic method of sphere location, the **Cube involute** group becomes available, where it is necessary to select the location zone type.
- Location zones of triangular shape will be set by using the **Triangular zone** switch.
 - Location zones of quadrangular shape will be set by using the **Rectangular zone** switch.

After setting all the parameters, press the **OK** button. For canceling, the changes applied press the **Cancel** button.

Sensors arrangement scheme setup

For setting the sensors arrangement scheme, press the **Details** button in the **Location Scheme Settings** dialog box. After that the **3D-Sphere details setup dialog** dialog box will appear.

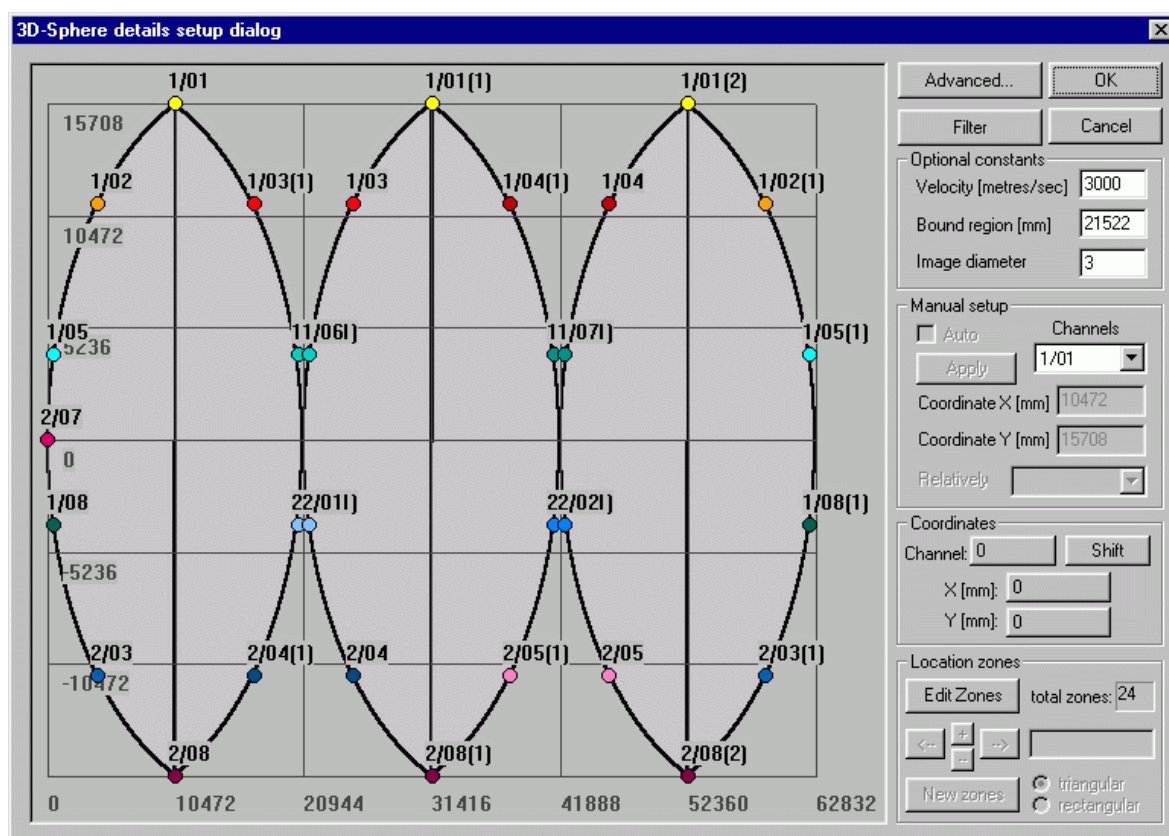


Fig. 7.12. **3D-Sphere details setup dialog** dialog box

Operations with this dialog box are described in the Chapter “*Sensors arrangement scheme setup*” on page 84. From among the features of this location type it is worth noting, that when using the sector method of sphere location, there is a possibility of manually changing only one coordinate (calculation of the second coordinate will

be performed automatically), as well as different graphic representation of a sphere (depending on the scanning method selection).

7.11. Bottom location

When using the bottom location, the examined area is characterized by two different dimensions: bottom radius (radius) and the embedding value (height). This location type is used for controlling the bottoms of reservoirs, including buried reservoirs (inaccessible for sensors arrangement).

Including sensors into location group

For setting the sensors arrangement scheme, press the **Select** button in the **Location Scheme Settings** dialog box. After that the **Select channels for bottom location scheme** dialog box will appear.

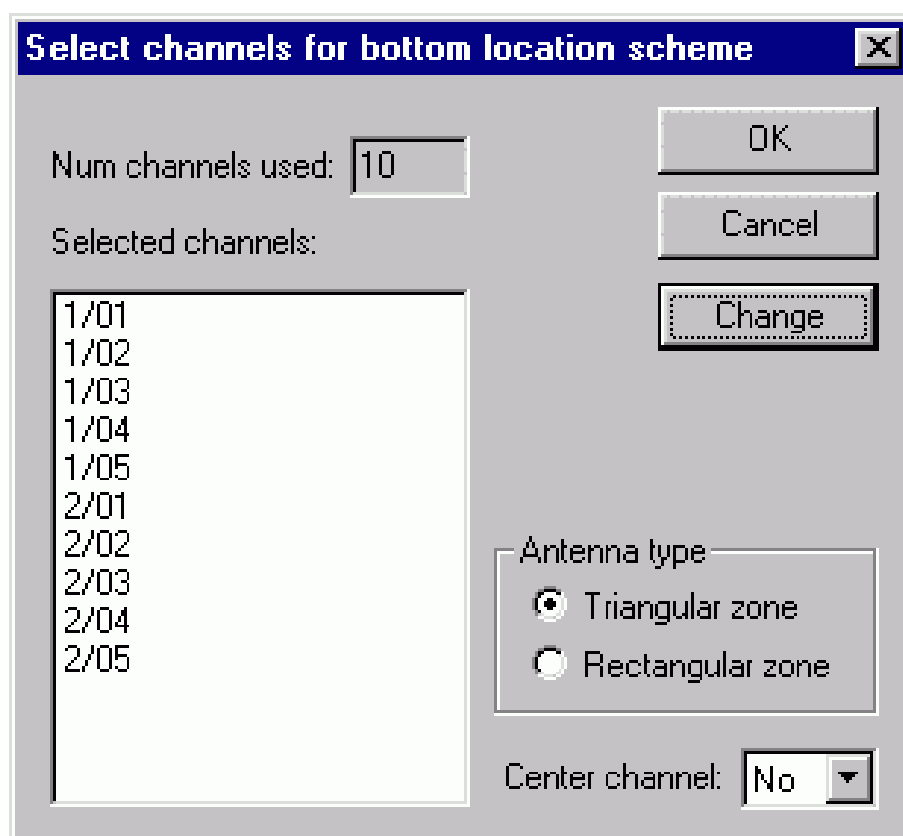


Fig. 7.13. **Select channels for bottom location scheme** dialog box

This dialog box sets sensors distribution on sectors of the bottom.

For selecting the sensors, participating in location, press the **Change** button. After that, the **Select channels** dialog box, similar to the **Including or Excluding Sensors from group** dialog box will appear, the operations with which are described on page 89. After closing the **Select channels** window the number of the selected channels will be specified in the **Num channels used** field, and these channels will be listed in the **Selected Channels** list.

Then specify the number of a sensor (if exists) located in the middle of the sphere (within the environment) in the **Center channel** list. In case such sensor does not exist, select **No**.

In order to select the shape of the location zone activate either the **Triangular** switch for zones of triangular shape, or the **Rectangular** switch for zones of quadrangular shape in the **Zone** type group.

After setting all the parameters press the **OK** button. For canceling the changes applied, press the **Cancel** button.

Sensors arrangement scheme setup

For setting the sensors arrangement scheme, press the **Details** button in the **Location Scheme Settings** dialog box. After that the **Bottom details setup dialog** dialog box will appear.

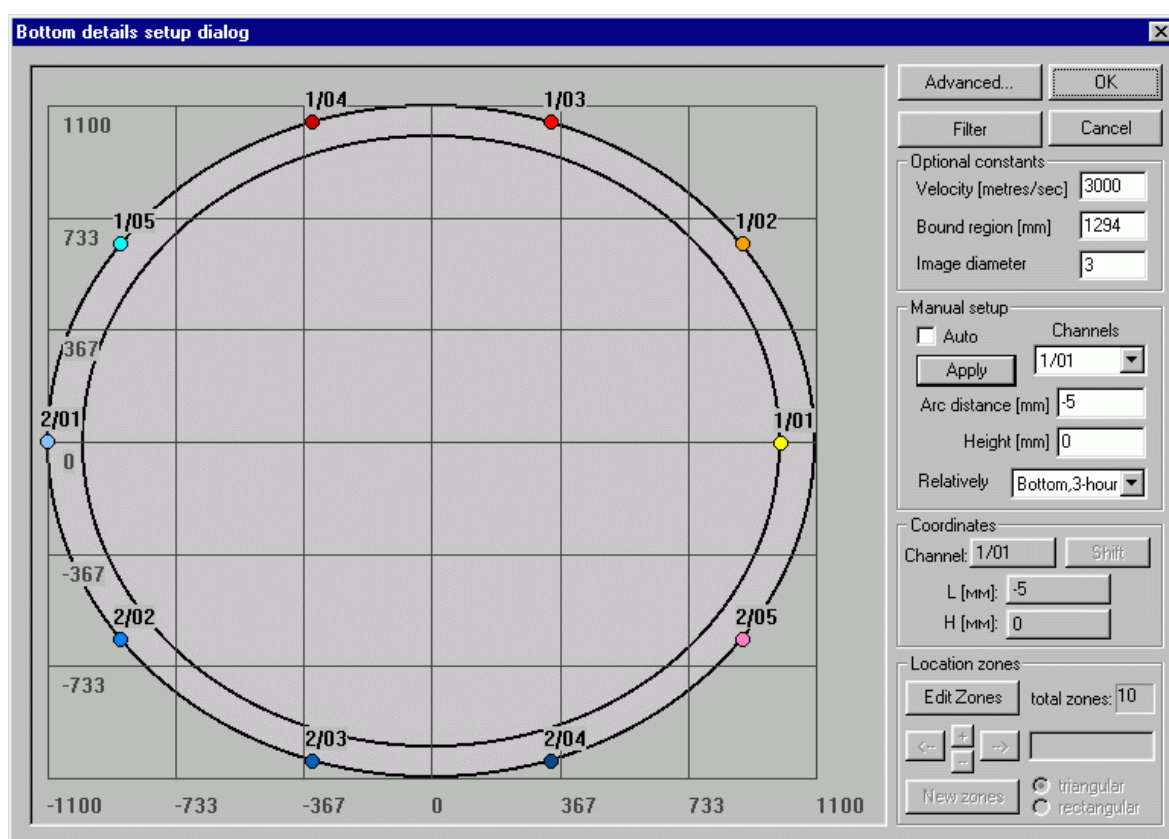


Fig. 7.14. **Bottom details setup dialog** dialog box

Operations with this dialog box are described in the Chapter “*Sensors arrangement scheme setup*” on page 84. Among the features of this location type it is worth mentioning the following points:

- ◇ During the bottom location the arc length (**Arc distance** entry field) and the height of sensor placing (**Height** entry field) are entered in the **Bottom details setup dialog** dialog box instead of the X and Y coordinates. Arc length is the distance on the arc of the bottom’s circumference, counted from the extreme right-hand position (to where the 1st sensor is set by default) counter-clockwise.
- ◇ Relation of X and Y coordinates to the arc length is determined by the formulae:

$$X = R \cos(L / 2\pi R)$$

$$Y = R \sin(L / 2\pi R)$$
, where

R is the bottom radius, L - arc length counted from the extreme right-hand position counter-clockwise to the place of installing the selected sensor.

For this location type, the reference points are the **Bottom, 3 hours**, which correspond to **01** sensor position in the figure.

7.12. 3D volume Location

When using the 3D volume location type the examined area is characterized by three dimensions (length, width and height). This location type is used for filled 3D-objects (e.g. - bridge pillars; pressure reservoirs, filled with liquid).

Including sensors into location group

In order to include the sensors into a location group, press the **Select** button in the **Location Scheme Settings** dialog box. After that, the **Select channels** dialog box, similar to the **Including or Excluding sensors from group** dialog box will appear, operations with which are described on page 89.

Note that when using the 3D volume location it is necessary to use not less than five sensors.

After setting all the parameters, press the **OK** button. For canceling the changes applied, press the **Cancel** button.

Sensors arrangement scheme setup

For setting the sensors arrangement scheme press the **Details** button in the **Location Scheme Settings** dialog box. After that the **Three-Dimensional details setup** dialog box will appear.

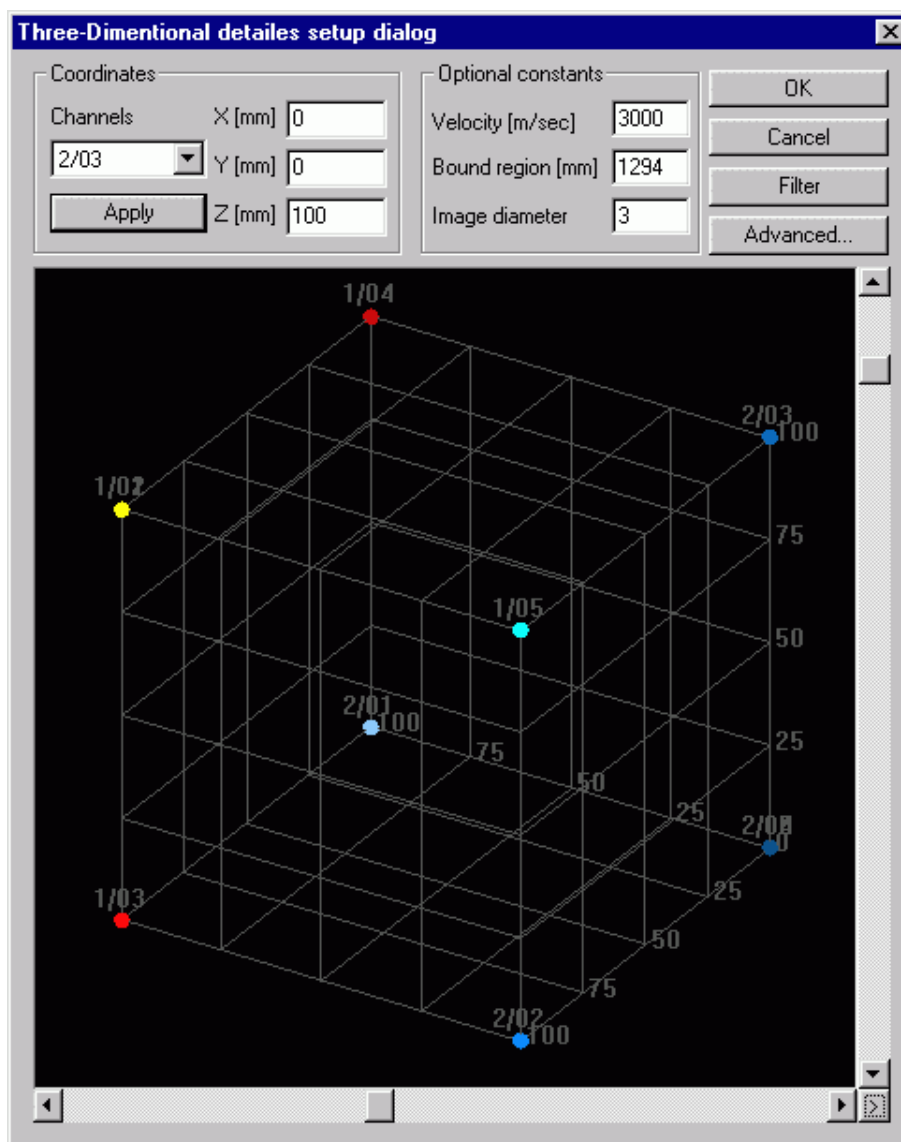


Fig. 7.15. **Three-dimensional details setup dialog** dialog box

Operations with this dialog box are described in the Chapter “*Sensors arrangement scheme setup*” on page 84 on page.

Among the features of this location type the following should be noted:

- ◇ availability of three coordinates;
- ◇ absence of location zones.

Availability of three coordinates in this location model provides for obtaining a three-dimensional rotating image in this dialog box. At that, there is no possibility for setting coordinates from the dialog box with the help of the mouse. When working with a three-dimensional image the following options are available:

- ◇ To stop rotation press the < button located in the lower right-hand corner of the dialog box.
- ◇ For rotating the image around the horizontal axis, use the horizontal scroll bar.
- ◇ For rotating the image around the vertical axis, use the vertical scroll bar.

7.13. Zone location

Zone location is used mainly for vessels diagnostics:

- ◇ in especially difficult cases, when there is practically no access to the examined section of the object;
- ◇ when the AE pulse propulsion speed is unknown;
- ◇ when other location types provide no information on the defect present.

In such cases zone location serves as rapid analysis for detection of the AE sources availability without determining their coordinates. With its help you can specify just approximately between which sensors the defect is located.

Including sensors into location group

In order to include the sensors into a location group, press the **Select** button in the **Location Scheme Settings** dialog box. After that the **Select channels** dialog box, similar to the dialog box **Including or Excluding sensors from group** dialog box will appear, operations with which are described on page 89.

After finishing the channels selection press the **OK** button, for canceling selection use the **Cancel** button.

Zone location scheme parameters

For setting the zone location scheme, press the **Details** button in the **Location Scheme Settings** dialog box. After that the **Zonary Details Setup Dialog** dialog box will appear.

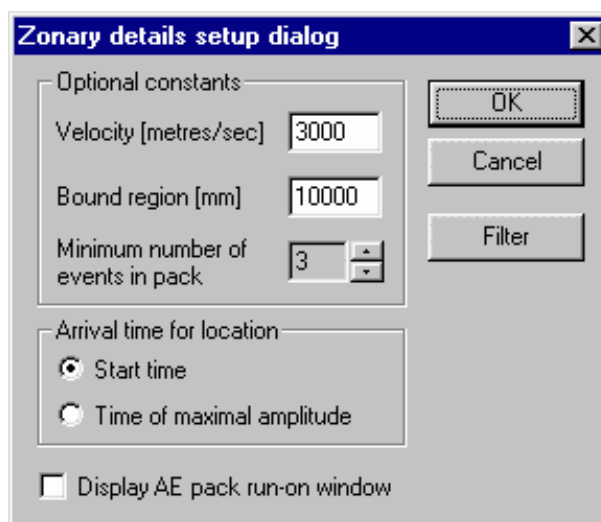


Fig. 7.16. **Zonary Details Setup Dialog** dialog box

Operations with this dialog box are described in Chapter “*Sensors arrangement scheme setup*” on page 84.

Among the features of this location type it is worth noting the absence of coordinates and location zones, as well as availability of the additional **Arrival time for location** group in the **Zonary details setup dialog** dialog box. In this group select the mode for performing location:

- ◇ After the event beginning time - with the help of the **Start time** switch;
- ◇ After the maximum amplitude time - with the help of the **Time of maximal amplitude** switch.

Displaying results

After setting all the parameters of the zone location scheme press the **OK** button in the **Location Scheme Settings** dialog box. Then the window for displaying the zone location results in a list-form will appear. The result of this location type is selection of groups of events (packs), arriving in series to several different sensors (not less than two) with common arrival interval not exceeding the value set (this interval's value will be set in the **Zonary details setup dialog** dialog box by determining the cut-off zone and velocity).

In the table of the zone location results display window the figures are listed, representing the number of the packs selected, sorted after the first three (two) sensors of the pack. The sensors registering events in the pack will be set in the following way: the first sensor will be selected in the upper line and will set the table page; the second sensor will be selected from the table columns, the third sensor – from the table lines. The column with the largest number of the packs selected in comparison to other, identifies the possibility of a defect present between three selected sensors. Note that the possible defect will be located closer to the sensor, which number corresponds to the table page number. In case of a pack, consisting of two events, the line and column number coincide.

In a data file, filtered after zone location, the "**N of the pack**" parameter will appear (similar to source coordinates for other location types), which unites the AE events of one pack by its common sequence number.

7.14. Additional location options

For setting the additional location functions press the **Advanced** button in the location scheme parameters setup. After that the **Advanced location options** dialog box will appear.

Fig. 7.17. **Advanced Location Options** dialog box

- ◇ Enter the attenuation parameter value for selected location group in the **Amplitude attenuation, [dB/m]** field.
- ◇ For viewing the 3D-models of cylindrical and spherical vessels localization, activate the **Display 3D location window** switch.
- ◇ In order to create the location amplitude window, switch the **Display amplitude location window** switch on. Then, set the switch in the **Show amplitude location options** group made available, corresponding to the selected action:
 - for displaying in the location amplitude window the average amplitude in cluster, use the **Show cluster averaged amplitude** switch;
 - for displaying in the location amplitude window the maximum amplitude in cluster, activate the **Show maximum amplitude in cluster** switch.
- ◇ In order to select the method for location coordinates determination activate the corresponding switch in the **Use to calculate location** group:
 - for determining the coordinates after time differences of the AE signal arrival to sensor set the **...start time of AE events** switch;

- or determining the coordinates after time differences of the reaching the amplitude maximum by the AE events, use the ...**time of maximal amplitude of AE events** switch.

(These switches are available for all location types, except the zone location.)

- ◇ In order to check the truth of the obtained source coordinates values set the quadrangular zone type in the corresponding channel selection dialog. Then in the **Rectangular location options** group made available:

- activate the **Coordinate verification** switch;
- enter the permissible error value in the **Error value [mm]** entry field.

Note that this check can be performed based on possibility of the location coordinates determination algorithm after four sensors. The accuracy of the obtained values will be determined with the help of the correlation ("truth criterion ") $|X^2 + Y^2 - V^2 T^2| \leq \varepsilon^2$, where X и Y are the source coordinates, V - AE signal velocity, T - signal propagation time, ε - the settable error value (residual).

In case of non-fulfillment of the "truth criterion" at the V_0 velocity set in location, it is possible to match it within the limits specified in order to provide the possible equality with ε precision selected. For this:

- ◇ activate the **Variate velocity [m/s]** switch;
- ◇ specify the bearable interval of speed matching in the **from...to entry** fields, including the initial velocity value V_0 .

After setting all the parameters, press the **OK** button. For canceling the changes applied, press the **Cancel** button. Note that the 3D location window and the location amplitude window will be created together with other location windows.



We do not recommend keeping the windows of 3D location models open during the data collection because of the significant computer resources consumption for displaying them.

Controlling a 3D location model window

The 3D location model window is used for viewing the 3D models of cylindrical and spherical vessels location. After obtaining the images of 3D objects with the sensor arrangement scheme specified, the following actions are possible:

- ◇ For rotating the vessel around the horizontal axis, use the horizontal scroll bar;
- ◇ For rotating the vessel around the vertical axis, use the vertical scroll bar.
- ◇ For animation (simultaneous rotation of the vessel around both coordinate axes, passing thru the center of the vessel), press the < button. To stop rotation, depress the < button.

7.15. Filtering after location

For selecting the located events and performing the filtering, press the **Filter** button in the location schemes parameters setup window. After that the **Location Filter Dialog** dialog box will appear. Set the filtering after location parameters in the dialog box open.

Location filter dialog

Filter action

☐ Delete event record(s)

☒ Keep event record(s)

Coordinate intervals

	Lower limit	Upper limit
<input checked="" type="checkbox"/> X coordinate	0	628
<input checked="" type="checkbox"/> Y coordinate	-157	157
<input type="checkbox"/> Z coordinate	0	0

Saving options

☒ Save in file Browse

Filename (.ald)

☒ Do not delete unlocated events

Kept located events parameters

☒ Have to meet the amplitude criterium

☒ Location amplitude difference have to be no more than [dB]

☐ Time arrival difference have to be no less than [mks]

☐ Dead time for location [mks]

Fig. 7.18. **Location Filter Dialog** dialog box

- ◇ In the **Kept located events parameters** group select, when necessary, the criterion/criteria of the automatic located events screening, using the corresponding switch.

- *Amplitude criterion..*

This criterion satisfies the events with the amplitude of the signal (in dB), arriving at the nearest sensor, not less than the signal amplitude at the distant sensor. For using this criterion switch the **Have to meet the amplitude criterion** switch on.

- *Criterion of the location amplitudes discrepancy values..*

This criterion satisfies the events with the location amplitudes discrepancy values in the location of the defect for the events, forming a location couple (for linear location) or three (for plane location types), recalculated by the program considering the attenuation parameter and the distance from defect to sensor, does not exceed the specified value. For using this criterion, switch the **Location amplitude difference have to be more** switch on and specify the location amplitudes discrepancy value in the [dB] entry field.

- *Criterion of the AE pulse arrival time discrepancy..*

This criterion satisfies the events with the AE pulse arrival at sensors time discrepancies, forming a location couple (for linear location) or three (for plane location types), not less than the value specified. For using this criterion, switch the **Time arrival difference have to be no less than** switch on and specify the arrival time discrepancy in the [mcs] entry field.

- *Criterion of the location dead time.*

According to this criterion an event will be located, in case its arrival time to all the sensors, forming a location couple (for linear location) or three (for plane location types) will differ from the arrival times of the previous located event by not less, than the dead time value specified. For using this criterion switch the **Dead time for location** switch on and specify the dead time value in the [mcs] entry field.

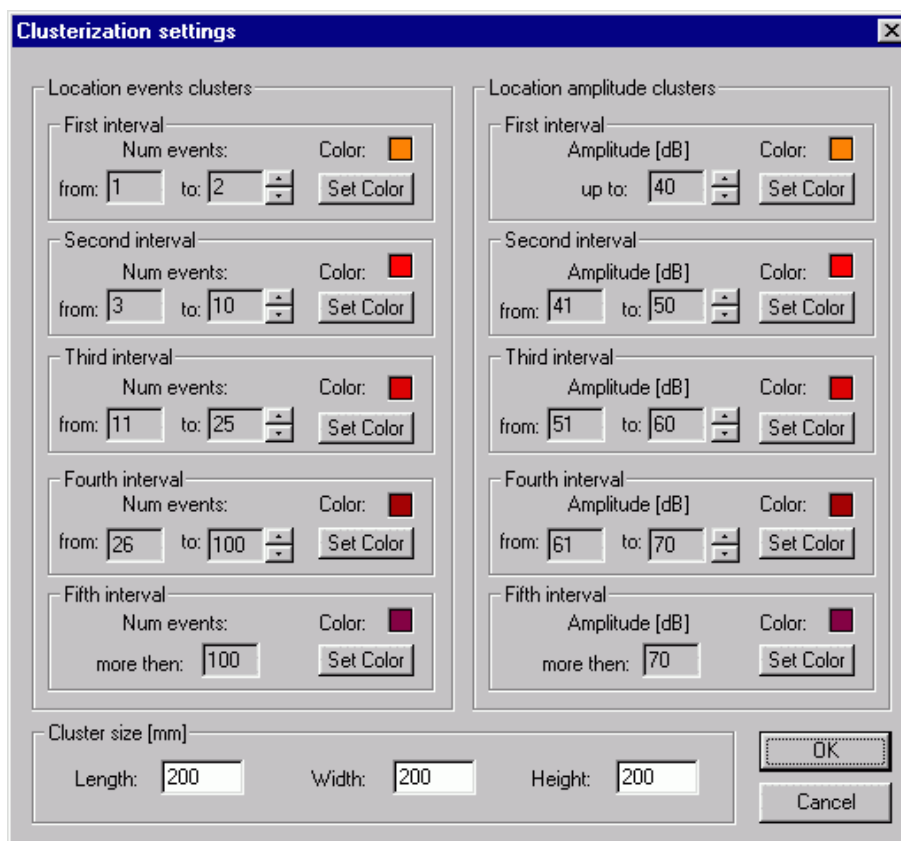
- ◇ In the **Coordinate intervals** group set the coordinates of the area, where the AE pulse source is located.
 - Set the **X-coordinate** switch, (and the **Y-coordinate** switch at plane location scheme; and the **Z-coordinate** switch at the 3D volume location scheme).
 - Enter the corresponding coordinates in the **Lower limit** and the **Upper limit** fields.In case the **X-coordinate** switch and the **Y-coordinate** switch, or both switches together are not activated, the whole coordinates range will be examined.
- ◇ In the **Filter action** group set the switch, corresponding to the necessary action on events:
 - for excluding the events which got into the selected zone, set the **Delete event record(s)** switch;
 - for excluding the events which did not get into the selected zone, set the **Keep event record(s)** switch.

For saving the filtering results, activate the **Save it in file** switch in the **Saving options** group. Then, specify the file name in the **File name .aid** entry field, or press the **Browse** button and select the necessary file with the help of the **Open file** standard dialog box. For saving all the events (and not only the located events) into a file, activate the **Do not delete unlocated events** switch.

After setting all the parameters, press the **OK** button. For canceling the changes applied, press the **Cancel** button.

7.16. Clusterization

The program provides for possibility of displaying the number of located events and location amplitude. For this press the **Change settings** button in the **Clusterization legend** group in the **Location scheme settings** dialog box. After that the **Clusterization settings** dialog box will appear.

Fig. 7.19. **Clusterization settings** dialog box

In the dialog box open set the following

- ◇ In the **Location events clusters** group with the help of **Num events** spinners set the ranges of all the registered events on every interval. Besides, in this group you can select the display color for every interval. Setting the color will be performed by pressing the **Set color** button in the corresponding subgroup and selecting the color in the **Color** standard dialog box.
- ◇ In the same way, the location amplitudes intervals and their corresponding colors will be selected in the **Location amplitude clusters** group.
- ◇ In the **Cluster size** group in the **Length, mm**, **Width, mm** and the **Height, mm** entry fields the cluster size will be set.

After setting the clusterization parameters, press the **OK** button. Control will return to the **Location Scheme Settings** dialog box. In the **Clusterization legend** group, the selected colors corresponding to different ranges of the registered events and location amplitude number will be displayed. The selected cluster size will as well be specified there.

